

Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

Reserve
aTC425
.R3U5

WATERSHED WORK PLAN

RABON CREEK WATERSHED

GREENVILLE AND LAURENS COUNTIES

SOUTH CAROLINA



U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
AND
THE FOREST SERVICE

AD-53 Bookplate
(1-63)

NATIONAL

**A
G
R
I
C
U
L
T
U
R
A
L**



LIBRARY

2341991

ADDENDUM

RABON CREEK WATERSHED, SOUTH CAROLINA

May 1975

The purpose of this addendum is to modify the planned principal spillway in Site 32 of the Rabon Creek Watershed to include an orifice in the riser.

The U. S. Department of Interior has expressed concern as to the effects of the proposed impoundment on downstream aquatic life in Rabon Creek and requested that the 7-day 10-year low flow be released continuously through the structure. To accomplish this an orifice will be designed in the riser of the principal spillway. The U. S. Geological Survey has estimated the 7-day 10-year low flow at the site to be about nine cubic feet per second.

Special drought measurements were made on Rabon Creek at a point just above the proposed site in 1954 during the most critical drought on record. The drainage area at the gaging station is 89 square miles. The minimum flow recorded was 4.23 c.f.s. and occurred on October 7, 1954.

The estimated cost of installing the structure will not be affected by the addition of the orifice.

U. S. DEPT. OF AGRICULTURE
NATIONAL AGRICULTURAL LIBRARY

JUL 30 1976

CATALOGING - PREP.

ADDENDUM

RABON CREEK WATERSHED, SOUTH CAROLINA

November 1974

The purpose of this addendum is to add to the Rabon Creek Watershed Work Plan certain requirements of the Principles and Standards, which are: Part I - Benefit to Cost Comparisons; Part II - Abbreviated Four Account Displays; and Part III - Abbreviated Environmental Quality Plan.

PART I
BENEFIT TO COST COMPARISONS

Rabon Creek Watershed, South Carolina

Project costs based on 1973 prices, crop and pasture benefits based on current normalized prices, other benefits based on current prices, and benefit-cost ratio based on 5 7/8 percent interest rate are as follows:

- | | |
|--|-------------|
| 1. Annual costs | - \$176,800 |
| 2. Annual benefits | - \$316,800 |
| 3. Benefit-cost ratio | - 1.8 to 1 |
| 4. Benefit-cost ratio, excluding
local secondary benefits | - 1.6 to 1 |

November 1974

PART II
Selected Plan
NATIONAL ECONOMIC DEVELOPMENT ACCOUNT

Rabon Creek Watershed, South Carolina

<u>Components</u>	<u>Measures of effects</u>	<u>1/</u>
Beneficial effects:		
Value of users of increased output of goods and services		
a. flood prevention	\$ 98,200	
b. recreation	85,800	
c. M&I water	60,500	
d. incidental land enhancement	5,600	
e. utilization of unemployed and underemployed labor resources		
project construction and O&M	27,400	
Total beneficial effects		\$277,500
Adverse effects:		
Value of resources required for a plan		
two floodwater retarding structures, one multiple purpose reservoir, and recreation facilities		
project installation (structural measures)	\$155,900	
project administration	4,600	
O&M&R	16,300	
Total adverse effects		\$176,800
Net beneficial effects		\$100,700

1/ Average annual

November 1974

PART II
Selected Plan
ENVIRONMENTAL QUALITY ACCOUNT

Rabon Creek Watershed, South Carolina

<u>Components</u>	<u>Measures of effects</u>
Beneficial and adverse effects:	
A. Areas of natural beauty	<ol style="list-style-type: none">1. Creates three lakes with 40 miles of shoreline and 693 surface acres of water2. Project output makes available regional funds and resources that can be used to enhance the physical appearance of 215 farms3. Disrupts tranquility of rural environment by 49,000 recreational visitor-days4. Converts approximately 20 acres of the recreational development consisting of pine and mixed hardwoods with heavy, brushy undergrowth into a scenic landscape of native and planted trees, shrubs, and vegetation5. Inundates 693 acres presently consisting of bottom land hardwood, pine, and mixed hardwoods (690 acres), and pastureland (3 acres)6. Clears 25 acres of forest land and 2 acres of pastureland for dams, spillways, and borrow areas

B. Quality considerations of water, land, and air resources

1. Reduces floodwater damages on 3,020 acres by approximately 76 percent
2. Reduces sediment deposition into Lake Greenwood from the watershed by 75 percent
3. Reduces erosion by 20 percent on cropland and pastures, 50 percent on roadbanks and dirt roads, and 50 percent from gullies
4. Lowers average annual suspended sediment concentration from 630 mg/l to an average of 160 mg/l
5. Degrades air and water quality slightly during project construction

C. Biological resources and selected ecosystems

1. Creates 693 acres of lake fishing
2. Provides resting and roosting areas for waterfowl
3. Inundates 10.2 miles of stream with a low population of small non-game fish
4. Reduces bottom land wildlife habitat by 11 percent
5. Stops upstream migration of fish by the creation of the three lakes

D. Irreversible or irretrievable commitments

Converts 27 acres of forest land and pastureland to dam sites, and emergency and chute spillways and 693 acres of forest land and pastureland to sediment and permanent water pools in the three lakes; inundates 10.2 miles of streams

PART II
Selected Plan
REGIONAL DEVELOPMENT ACCOUNT

Rabon Creek Watershed, South Carolina

<u>Components</u>	<u>Measures of effects ^{1/}</u>	
	<u>State of</u> <u>South Carolina</u>	<u>Rest of</u> <u>Nation</u>
A. Income		
Beneficial effects:		
Value of increased output of goods and services to users residing in the region		
1. Flood prevention	\$ 98,200	-
2. Recreation	85,800	-
3. M&I water	60,500	-
4. Incidental land enhancement	5,600	-
5. Utilization of regional unemployed or underemployed labor resources project construction and O&M	27,400	-
6. Secondary	39,300	-
Total beneficial effects	\$316,800	-

Adverse effects:

Value of resources
contributed from within
the region to achieve the
outputs

Two floodwater retarding structures, one multiple purpose reservoir, and recreational facilities project installation (structural measures)	\$ 51,900	\$104,000
project administration	600	4,000
O&M&R	16,300	-
Total adverse effects	\$ 68,800	\$108,000
Net beneficial effects	\$248,000	-\$108,000

1/ Average annual

B. Employment

Beneficial effects:

Increases the number
and types of jobs

1. Employment in agriculture, service, and trade activities	111 permanent semi-skilled jobs	-
2. Employment for project construction	50 semi-skilled jobs for one year	-
3. Employment for project O&M&R	1 permanent semi-skilled job	-
Total beneficial effects	112 permanent semi-skilled jobs	-
	50 semi-skilled jobs for one year	

Adverse effects:

Decreases number
and types of jobs

1. Loss in agricul- tural employment of project take area	1 man year of agricultural employment	-
2. Loss in forestry industry employment of project take area	1 man year of forestry industry employment	-
Total adverse effects	2 permanent semi-skilled jobs	-
Net beneficial effects	110 permanent semi-skilled jobs	-
	50 semi-skilled jobs for one year	

C. Population Distribution

Beneficial effects	Water supply	-
	and lake	
	creates in-	
	migration and	
	seasonal	
	residents	

Adverse effects	-	-
-----------------	---	---

D. Regional Economic Base
and Stability

Beneficial effects	Creates 110	-
	permanent semi-	
	skilled jobs	
	and 50 short-term	
	semi-skilled jobs	
	in an area where	
	13 percent of the	
	families have	
	incomes less than	
	the national	
	poverty level	

Provides a	-
dependable	
source of water	
to meet all	
projected future	
needs of the area	

Adverse effects	-	-
-----------------	---	---

November 1974

PART II
Selected Plan
SOCIAL WELL-BEING ACCOUNT

Rabon Creek Watershed, South Carolina

<u>Components</u>	<u>Measures of effects</u>																								
Beneficial and adverse effects																									
A. Real income distribution	<div>1. Creates 110 low to medium income permanent jobs for area residents</div> <div>2. Creates regional income benefit distribution of \$316,800 by income class as follows:</div> <table><thead><tr><th>Income Class (dollars)</th><th>Percentage of Adjusted Gross Income in Class</th><th>Percentage Benefits in Class</th></tr></thead><tbody><tr><td>Less than 3,000</td><td>3</td><td>12</td></tr><tr><td>3,000-10,000</td><td>43</td><td>63</td></tr><tr><td>More than 10,000</td><td>54</td><td>25</td></tr></tbody></table> <div>3. Local costs to be borne by region total \$66,700 with distribution by income class as follows:</div> <table><thead><tr><th>Income Class (dollars)</th><th>Percentage of Adjusted Gross Income in Class</th><th>Percentage Contribution in Class</th></tr></thead><tbody><tr><td>Less than 3,000</td><td>3</td><td>4</td></tr><tr><td>3,000-10,000</td><td>43</td><td>46</td></tr><tr><td>More than 10,000</td><td>54</td><td>50</td></tr></tbody></table>	Income Class (dollars)	Percentage of Adjusted Gross Income in Class	Percentage Benefits in Class	Less than 3,000	3	12	3,000-10,000	43	63	More than 10,000	54	25	Income Class (dollars)	Percentage of Adjusted Gross Income in Class	Percentage Contribution in Class	Less than 3,000	3	4	3,000-10,000	43	46	More than 10,000	54	50
Income Class (dollars)	Percentage of Adjusted Gross Income in Class	Percentage Benefits in Class																							
Less than 3,000	3	12																							
3,000-10,000	43	63																							
More than 10,000	54	25																							
Income Class (dollars)	Percentage of Adjusted Gross Income in Class	Percentage Contribution in Class																							
Less than 3,000	3	4																							
3,000-10,000	43	46																							
More than 10,000	54	50																							
B. Life, health, and safety	Provides flood protection to roads and bridges																								
C. Recreational opportunities	Creates 49,000 recreational visitor-activities for a rural population																								

PART III
ABBREVIATED ENVIRONMENTAL QUALITY PLAN

Rabon Creek Watershed, South Carolina

The goals of this environmental quality plan for the Rabon Creek Watershed are to: (1) preserve and enhance areas of natural beauty; (2) maintain and improve the quality of water, land, and air resources; and (3) preserve and enhance the biological resources and ecosystems of the watershed.

The principal environmental problems in the watershed are soil erosion and resulting sediment deposition on flood plains and in Lake Greenwood, lack of adequate water supply, and lack of water based recreational opportunities.

The watershed lies in a rural setting of gently rolling Piedmont terrain interspersed with cropland, pastureland, and forest land. Soil erosion was very severe during the first half of the century when cotton was the principal cash crop. Critically eroding areas and gullies give evidence of past abuse. Shortleaf pines are the dominant forest species and are usually found mixed with hardwoods in the natural stands. Pastures are usually planted to fescue, but improved bermuda grass and native grasses are also found. Many acres of pastureland suffer from over-grazing and lack proper management.

Clearing of mixed pine and hardwood stands for solid replanting of pine creates habitat for quail during the first few years of growth; however, solid pine stands five years old or older provide poor habitat for open land wildlife species. Clearing of bottom land hardwoods reduces this type of habitat for deer and other wildlife. Erosion of roadbanks, gullies, and galled areas contributes heavy sediment loads to Rabon Creek, its tributaries, and Lake Greenwood. Sediment deposition destroys trees and other vegetation, clogs stream channels, and reduces fish reproduction in areas of Lake Greenwood. No public recreational areas are within 20 miles of the watershed. The community does not have an adequate source of water supply.

Component needs for solving problems relating to specific environmental conditions are listed below:

1. Areas of natural beauty
 - a. reduce sheet, gully, and roadside erosion in the uplands
 - b. reduce sediment into Lake Greenwood

2. Quality of water, land, and air resources

- a. improve the quality of the streamflow of Rabon Creek by reducing the sediment being delivered to the streams and Lake Greenwood from soil erosion
- b. protect the land from deterioration by reducing erosion and sediment
- c. maintain and enhance soil productivity
- d. provide residents of the community with a dependable water supply
- e. reduce flood damages to crops, pastures, forests, and fixed improvements

3. Biological resources and ecosystems

Preserve and enhance the habitat conditions for species of fish and wildlife present in the watershed by providing more dependable food supplies, avoiding excessive destruction of habitat, reducing losses of habitat from flooding and sedimentation, creating additional cover for selected species of wildlife and creating additional habitat for fish

The plan elements for environmental quality consist of land treatment and structural measures. Cropland treatment measures would consist of conservation treatment systems as follows: (1) terraces, grassed waterways, field borders, land leveling, stripcropping, contour farming, and conservation cropping systems; and (2) grassed waterways, field borders, land leveling, contour farming, conservation cropping systems, and no-till planting. In addition, areas scattered throughout the watershed would receive partial treatment. Critically eroding cropland would receive special treatment for the establishment of permanent grasses. Wildlife food plantings would be included in the field border plantings, and other areas where supply is low.

The major treatment system on pastureland would include land leveling, removal of undesirable plant species, planting improved grasses and legumes, cross-fencing, ponds, and a complete fertilization and liming program.

Conservation practices on forest land include tree planting, thinning, harvest cutting, wildlife food plantings, timber stand improvement, and protection from grazing and wild fires. In addition, critically eroding areas in forests would receive special treatment to establish permanent vegetation and improve wildlife habitat.

Treatment of land in other uses would include erosion control practices, such as mulching and planting grasses, planting trees, and planting wildlife food plants. Special treatment would be applied to roadbanks and dirt roads. Practices for the improvement of fish habitat

and recreational areas would be applied.

Planned land treatment systems would include changed land use on those areas being used beyond their capabilities. These areas would be primarily cropland areas where erosion is a problem. Treatment would be the establishment of grasses, trees, or wildlife cover.

Landowners would be encouraged to apply and maintain land treatment measures by the local soil and water conservation districts, with assistance from the Soil Conservation Service, Forest Service, and other agencies. Financial assistance, usually on a cost-share basis, is available through the Rural Environmental Conservation Program administered by the Agricultural Stabilization and Conservation Service.

One multiple purpose structure would be installed to store sediment, floodwater, municipal, industrial, and recreation water. Associated with the structure would be a recreational development providing water based recreational facilities and access to the lake. The structural measure would be implemented by the local soil and water conservation districts, the watershed conservation district, and the Laurens County Water Resources Commission. Cost sharing funds are available under Public Law 566, as amended.

The estimated installation costs of the elements of the environmental quality plan are as follows:

1. Application of land treatment measures - \$ 800,000
2. One multiple purpose structure - \$2,000,000
3. Recreational facilities - \$ 342,200

The total installation cost of the environmental quality plan is estimated to be \$3,142,200.

The environmental effects that would result from installation of the environmental quality plan are as follows:

1. Areas of natural beauty
 - a. enhance the appearance of the farms in the watershed through application and maintenance of land treatment measures
 - b. improve the scenic quality of roadsides and galled areas by shaping and revegetation
 - c. improve aesthetic quality of the landscape by providing a 540 acre lake in a wooded and grassed setting

2. Quality of water, land, and air resources

- a. reduce the sediment load carried by Rabon Creek through the reduction of erosion and the storage of sediment in the structure
- b. reduce the deterioration of the land resource base by special treatment of critically eroding areas and improved conservation treatment
- c. reduce flooding on 1,200 acres of flood plain land along Rabon Creek below the structure to the degree that this land could be used for improved pasture
- d. provide citizens of Laurens County an adequate water supply through the year 2000
- e. reduce maintenance to roads and bridges along Rabon Creek below the structure
- f. reduce sediment deposited in Lake Greenwood by 44 acre feet per year
- g. slightly degrade air and water quality during project construction

3. Biological resources

- a. enhance the fishery habitat in Lake Greenwood by reducing sediment deposited
- b. change 540 acres of forest and pasture habitat to lake fishery
- c. improve wildlife habitat on the upland through installation of land treatment measures

4. Other

Provide water based recreational opportunities for an estimated 49,000 visitor days per year

5. Irreversible or irretrievable commitments

Require a loss of 564 acres of forest and three acres of pasture for the pool, dam, and spillway; inundate 6.5 miles of stream

WATERSHED WORK PLAN AGREEMENT

between the

Laurens Soil and Water Conservation District
Greenville County Soil and Water Conservation District
Rabon Creek Watershed Conservation District
Laurens County Water Resources Commission

(hereinafter referred to as the Sponsoring Local Organizations)
State of South Carolina

and the

Soil Conservation Service
United States Department of Agriculture
(hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organizations for assistance in preparing a plan for works of improvement for the Rabon Creek Watershed, State of South Carolina, under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress; 68 Stat. 666), as amended; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organizations and the Service a mutually satisfactory plan for works of improvement for the Rabon Creek Watershed, State of South Carolina, hereinafter referred to as the watershed work plan, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organizations and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan can be installed in about five years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed work plan:

1. The Sponsoring Local Organizations will acquire such land rights as will be needed in connection with the works of improvement. The percentages of this cost to be borne by the Sponsoring Local Organizations and the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organizations (percent)</u>	<u>Service (percent)</u>	<u>Estimated Land Rights Cost (dollars)</u>
Multiple purpose Structure 32 and Recreational Facilities			
Payment to land- owners for about 1,154 acres	56.0	44.0	376,900
Land appraisal fees	56.0	44.0	1,000
Cost of alteration or modification of improvements <u>1/</u>	56.0	44.0	32,100
Legal fees, survey costs, flowage easements, and other	100	0	26,800
All other structural measures	100	0	155,600

1/ Including necessary engineering services, construction, and additional land costs.

The Sponsoring Local Organizations agree that all land acquired or improved with P.L. 566 financial or credit assistance will not be sold or otherwise disposed of for the evaluated life of the project except to a public agency which will continue to maintain and operate the development in accordance with the Operation and Maintenance Agreement.

2. The Rabon Creek Watershed Conservation District assures that comparable replacement dwellings will be available for individuals and persons displaced from dwellings, and will provide relocation assistance advisory services and relocation assistance, make the relocation payments to displaced persons, and otherwise comply with the real property acquisition policies contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. The costs of relocation payments will be shared by the Rabon Creek Watershed Conservation District and the Service as follows:

	<u>Rabon Creek Watershed Conservation District</u> (percent)	<u>Service</u> (percent)	<u>Estimated Relocation Payment Costs</u> (dollars)
Relocation Payments	41.9	58.1	0 <u>1/</u>

- 1/ Investigation has disclosed that under present conditions the project measures will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, relocation payments will be cost-shared in accordance with the percentages shown.
3. The Rabon Creek Watershed Conservation District will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to state law as may be needed in the installation and operation of the works of improvement.

4. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organizations and by the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organizations (percent)</u>	<u>Service (percent)</u>	<u>Estimated Construction Cost (dollars)</u>
Multiple Purpose Structure 32			
a. Grubbing pool area and water release device	100	0	83,700
b. All other construction costs	21.7	78.3	1,227,000
Recreational Facilities	50.0	50.0	208,600
Two Floodwater Retarding Structures	0	100	431,400

5. The percentages of the engineering costs to be borne by the Sponsoring Local Organizations and by the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organizations (percent)</u>	<u>Service (percent)</u>	<u>Estimated Engineering Costs (dollars)</u>
Multiple Purpose Structure 32			
a. Grubbing pool area and water release device	100	0	300
b. All other engineering costs	14.0	86.0	64,000
Recreational Facilities	50.0	50.0	12,000
Two Floodwater Retarding Structures	0	100	26,000

6. The Sponsoring Local Organizations and the Service will each bear the costs of Project Administration which it incurs, estimated to be \$11,200 and \$70,200 respectively.
7. The Greenville County and Laurens Soil and Water Conservation Districts will obtain agreements from owners of not less than 50 percent of the land above each reservoir and floodwater retarding structure that they will carry out conservation plans on their land.
8. The Greenville County and Laurens Soil and Water Conservation Districts will provide assistance to land-owners and operators to assure the installation of the land treatment measures shown in the watershed work plan. Costs of treating critically eroding areas will be shared by the soil and water conservation districts and the Service by the following division of work:
- a. On 333 acres of critically eroding areas in fields to be stabilized with grass, the Service will furnish materials and the sponsors will prepare seedbeds and establish vegetation.

- b. On 90 acres of critically eroding areas in forests to be stabilized by planting trees, the Service will pay the cost of preparing planting sites and planting trees and the sponsors will furnish trees and mulch.
 - c. On 27 acres of gullies, the Service will furnish materials and construct needed structures, and the sponsors will prepare seedbeds, plant seeds and perform other work as needed on the gullies and constructed structures.
 - d. On 15 acres of critically eroding county roads, the Service will furnish materials and establish vegetation and the sponsors will prepare sites.
- 9. The Greenville County and Laurens Soil and Water Conservation Districts will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.
 - 10. The Rabon Creek Watershed Conservation District will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.
 - 11. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.
 - 12. This agreement is not a fund obligating document. Financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the availability of appropriations for this purpose.

A separate agreement will be entered into between the Service and the Sponsoring Local Organizations before either party initiates work involving funds of the other party. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

13. The watershed work plan may be amended or revised, and this agreement may be modified or terminated only by mutual agreement of the parties hereto except for cause. The Service may terminate financial and other assistance in whole, or in part, at any time whenever it is determined that the Sponsoring Local Organization has failed to comply with the conditions of this agreement. The Service shall promptly notify the Sponsoring Local Organization in writing of the determination and the reasons for the termination, together with the effective date. Payments made to the Sponsoring Local Organization or recoveries by the Service under projects terminated for cause shall be in accord with the legal rights and liabilities of the parties.

An amendment to incorporate changes affecting one specific structural measure may be made by mutual agreement between the Service and the sponsor(s) having specific responsibilities for the particular structural measure involved.

14. No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.
15. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964 and the regulations of the Secretary of Agriculture (7 C.F.R. 15.1-15.12), which provide that no person in the United States shall on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any activity receiving federal financial assistance.
16. This agreement will not become effective until the Service has issued a notification of approval and authorizes assistance.

LAURENS SOIL AND WATER CONSERVATION DISTRICT

By Russ J. Jackson
Title Chairman
Address RT. 3, Clinton, S.C. 29325
Zip Code
Date 5-20-74

The signing of this agreement was authorized by a resolution of the governing body of the Laurens Soil and Water Conservation District adopted at a meeting held on 5-20-74.

J. M. Tinsley
(Secretary, Laurens Soil and Water Conservation District)
Date 5-20-74

GREENVILLE COUNTY SOIL AND WATER CONSERVATION DISTRICT

By A. B. Bennett
Title Chairman
Address P.O. Box 10328, Fed. Sta. Greenville, S.C.
Zip Code
Date 5-24-74

The signing of this agreement was authorized by a resolution of the governing body of the Greenville County Soil and Water Conservation District adopted at a meeting held on _____.

Ben R. Leonard
(Secretary, Greenville County Soil and Water Conservation District)
Date 5-24-74

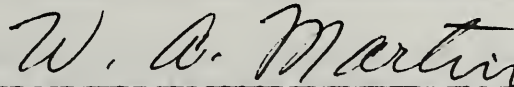
RABON CREEK WATERSHED CONSERVATION DISTRICT

By Title ChairmanAddress Route 2, Laurens, S.C. 29360

Zip Code

Date 5-13-74

The signing of this agreement was authorized by a resolution of the governing body of the Rabon Creek Watershed Conservation District adopted at a meeting held on 5-13-74.



(Secretary, Rabon Creek Watershed Conservation District)

Date 5-13-74

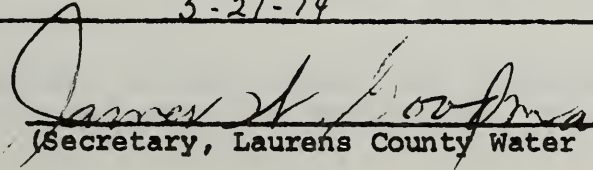
LAURENS COUNTY WATER RESOURCES COMMISSION

By Title ChairmanAddress Rt. 2, Laurens, S.C. 29360

Zip Code

Date 5-21-74

The signing of this agreement was authorized by a resolution of the governing body of the Laurens County Water Resources Commission adopted at a meeting held on 5-21-74.



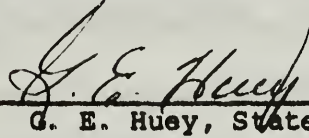
(Secretary, Laurens County Water Resources Commission)

Date 5-21-74

Appropriate and careful consideration has been given to the environmental statement prepared for this project and to the environmental aspects thereof.

SOIL CONSERVATION SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

Approved by:



G. E. Huey, State Conservationist

Date:

DEC 3 1974

WATERSHED WORK PLAN

RABON CREEK WATERSHED

Greenville and Laurens Counties
South Carolina

Prepared under the Authority of the
Watershed Protection and Flood Prevention
Act (Public Law 566, 83d Congress,
68 Stat. 666), as amended.

Prepared by: Laurens Soil and Water Conservation District
Greenville County Soil and Water Conservation District
Rabon Creek Watershed Conservation District
Laurens County Water Resources Commission

With Assistance by:

U.S. Department of Agriculture, Soil Conservation Service
U.S. Department of Agriculture, Forest Service

NOVEMBER 1974

T A B L E O F C O N T E N T S

	<u>Page</u>
SUMMARY OF PLAN	1
ENVIRONMENTAL SETTING	2
Physical Resources	2
Economic Data	6
Fish and Wildlife Resources	8
Recreational Resources	9
Archeological and Historical Values	10
Soil, Water and Plant Management Status	10
WATER AND RELATED LAND RESOURCE PROBLEMS	11
Land Treatment	11
Floodwater Damage	12
Erosion Damages	13
Sediment Damage	14
Municipal and Industrial Water	15
Recreation	15
Fish and Wildlife	16
Economic and Social	16
Water Quality Problems	17
PROJECTS OF OTHER AGENCIES	17
PROJECT FORMULATION	18
Objectives	18
Environmental Considerations	19
Alternatives	19
WORKS OF IMPROVEMENT TO BE INSTALLED	21
Land Treatment Measures	21
Structural Measures	23
EXPLANATION OF INSTALLATION COSTS	31
EFFECTS OF WORKS OF IMPROVEMENT	33
Flood Prevention, Erosion and Sediment	33
Water Supply	35
Fish and Wildlife and Recreation	35
Archeological Historic, and Scientific	36
Economic and Social	36
Other	37

PROJECT BENEFITS	37
COMPARISON OF BENEFITS AND COSTS	38
PROJECT INSTALLATION	38
FINANCING PROJECT INSTALLATION	40
OPERATION AND MAINTENANCE	41

TABLES

TABLE 1	- Estimated Project Installation Cost
TABLE 1A	- Status of Watershed Works of Improvement
TABLE 2	- Estimated Structural Cost Distribution
TABLE 2A	- Cost Allocation and Cost Sharing Summary
TABLE 2B	- Recreational Facilities, Estimated Construction Costs
TABLE 3	- Structural Data, Structures With Planned Storage Capacity
TABLE 4	- Annual Cost
TABLE 5	- Estimated Average Annual Flood Damage Reduction Benefits
TABLE 6	- Comparison of Benefits and Costs for Structural Measures
TABLE 7	- Construction Units
TABLE 8	- Water Wells in Rabon Creek Watershed, Maximum Consumption from Wells and their Chemical Analyses
TABLE 9	- Characteristics of Streams in Rabon Creek Watershed
TABLE 10	- Surface Water Quality in Rabon Creek Watershed
TABLE 11	- Quality Standards for Class "B" Waters
TABLE 12	- South Carolina Drinking Water Standards

INVESTIGATIONS AND ANALYSES	65
Land Use and Treatment	65
Structures	65
Additional Storage Potential	67
Hydraulic and Hydrologic	68
Geology	68
Fish and Wildlife	69
Economics	70

MAPS

Project Map
Public Recreation Development Area
North Rabon Creek Recreational Area
South Rabon Creek Recreational Area

WATERSHED WORK PLAN
RABON CREEK WATERSHED
Greenville and Laurens Counties
South Carolina

November 1974

SUMMARY OF PLAN

Rabon Creek Watershed is located in southern Greenville County and the western part of Laurens County. It comprises an area of 85,500 acres, of which 12,500 acres are in Greenville County and 73,000 acres in Laurens County. The watershed is in the upper Piedmont region of South Carolina.

Sponsors of the project are the Greenville County Soil and Water Conservation District, the Laurens Soil and Water Conservation District, the Rabon Creek Watershed Conservation District, and the Laurens County Water Resources Commission.

Almost all of the land in the watershed is in small, family type farm ownership. Farm incomes are generally low. In Laurens County, the rate of unemployment has been consistently higher than the state average.

Problems on the uplands are sheet erosion, critically eroding areas, and active gullies. Major flooding problems are floodwater damages to crops, pastures, roads, and bridges, and sediment damages to flood plain land and Lake Greenwood. Identified needs include a dependable domestic and industrial water supply, and water based recreational opportunities.

The land treatment systems planned for installation will result in adequate treatment of 19,565 acres including 465 acres of critically eroding areas. Three structures, two of which are single purpose floodwater retarding structures and the other a multiple purpose structure for flood prevention, municipal and industrial water supply, and public recreation, will be installed during a five year period.

The structures will be earthfill dams with heights ranging from 45 to 57 feet. Sediment pools of Structures 20 and 21 and the municipal and industrial pool of Structure 32 will have pool areas of 60, 93, and 540 acres respectively. All of the pools will be stocked with fish. Land needed for dams, spillways, and borrow areas amounts to 51 acres. Dams, spillways and borrow areas will be vegetated as a part of the construction contract.

The recreational development areas at Site 32 have a design capacity of 500 people with boating, fishing, and picnicking as the major recreational opportunities. A benefit of 49,000 visitor days per year will be created by the recreational development in association with the multiple purpose structure.

The land treatment and structural measures will reduce floodwater and sediment damages by about 75 percent. The multiple purpose structure will

store water for a projected population of 76,000 people by the year 2000. An estimated 120 home sites will be developed adjacent to the pools. One hundred ten new jobs will be created.

About 10.2 miles of stream channels will be inundated by the three pools. Fish migration will be stopped at the dams. Some increased traffic, noise, and refuse disposal problems will result from increased activity in the watershed.

Installation costs will be shared by PL-566 and other funds as follows:

	<u>PL-566</u>	<u>Other</u>	<u>Total</u>
Land Treatment	\$ 189,600	\$ 564,700	\$ 754,300
Structural Measures			
Construction	1,496,400	454,300	1,950,700
Engineering	87,000	15,300	102,300
Land Rights	180,400	412,000	592,400
Administration	70,200	11,200	81,400
Total Structural Measures	<u>1,834,000</u>	<u>892,800</u>	<u>2,726,800</u>
TOTAL PROJECT	\$2,023,600	\$1,457,500	\$3,481,100

The Rabon Creek Watershed Conservation District will be responsible for operating and maintaining Structures 20, 21, 32, and the recreational facilities. The Laurens County Water Resources Commission will be responsible for any operation and maintenance associated with the municipal water.

Average annual costs of the structural measures are estimated to be \$170,300. Average annual benefits are \$316,800. The ratio of benefits to costs is 1.9 to 1.

ENVIRONMENTAL SETTING 1/

Physical Resources

The Rabon Creek Watershed consists of 85,500 acres in the upper Piedmont region of South Carolina. About 85 percent or 73,000 acres are in Laurens County and the remaining 12,500 acres are in Greenville County. The watershed's 25 mile length extends from Fountain Inn, near the northwestern corner, to Rabon Creek's confluence with the Saluda River and Lake Greenwood. It is bordered by the headwaters of Durbin,

1/ All information and data, except as otherwise noted by reference to source, were collected during watershed planning investigation by the Soil Conservation Service and Forest Service, U.S. Department of Agriculture.

Beaverdam, and Warrior Creeks on the north; Little River on the east; and Reedy River on the west. The towns of Gray Court, Fountain Inn, and Hickory Tavern are located along the rim of the watershed. The city of Greenville is 20 miles north and the city of Laurens is one-quarter mile east of the watershed. The population of the watershed is about 4,000. All of the families are classed as rural, but more than half are rural non-farm.

Rabon Creek is a tributary of the Saluda River within the Santee River Basin. It is in the South Atlantic-Gulf Region and the Santee-Edisto subregion designated by the U.S. Water Resources Council^{1/}. This is the traditional cotton region and consists of gently sloping to rolling Southern Piedmont. The average annual precipitation ranges from 45 to 55 inches. The average annual temperature is 61 degrees Fahrenheit. The freeze-free season averages 240 days for the region as a whole, but it ranges from 220 to 290 days over the years^{2/}.

Soils with loamy surface layers and red or dark red subsoils are dominant throughout the region. A limited acreage of soils has a compacted or slightly cemented layer at 18 to 35 inches below the surface. This layer has slow permeability and restricts plant root development. Soils on the flood plains commonly are loamy. Many have free water at 18 to 40 inches below the soil surface for at least 60 days a year. These soils, with proper management, are some of the best suited for agriculture within the region.

The principal soil series in the watershed and the dominant

^{1/} Water Resources Regions and Subregions for the National Assessment of Water and Related Land Resources, July 1970, Water Resources Council, Washington, D.C.

^{2/} Atlas of River Basins of the United States, prepared by U.S. Department of Agriculture, Soil Conservation Service, June 1963.

characteristics of each are as follows^{1/}:

<u>Soil Series</u>	<u>Slope Range</u> (percent)	<u>Permeability</u>	<u>Depth</u>
Appling	2-10	Moderate	Deep
Cartecay-Toccoa ^{2/}	0- 2	Mod. Rapid	Deep
Cataula ^{3/}	2-10	Slow	Deep
Cecil	2-15	Moderate	Deep
Enon ^{4/}	2-15	Slow	Mod. Deep
Hiwassee	2-15	Moderate	Deep
Madison	2-40	Moderate	Deep
Pacolet	10-40	Moderate	Mod. Deep
Wilkes	6-40	Mod. Slow	Shallow

Classification of watershed soils by capability class and subclass is shown below^{5/}:

<u>Capability Class</u> <u>and Subclass</u>	<u>Percentage of</u> <u>Watershed Area</u>	<u>Number of</u> <u>Acres</u>
IIe	48.5	41,467
IIIe	22.5	20,466
IVe	14.7	12,568
VIe	3.1	4,874
VIIe	2.7	2,309
IIIW	8.5	6,400

The 6,400 acres of flood plain soils along Rabon Creek and its tributaries are classified IIIW land. The major problems on this land are floodwater and sediment damages to pasture and roads. Flooding has caused some cropland to be moved to the upland.

The land capability classification system is the grouping of soils to show, in a general way, their suitability for most kinds of field crops, pasture, and wildlife. It is a practical classification based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment. The letter "e" indicates that erosion is the primary hazard and "w" designates a wetness hazard. Capability

- ^{1/} Soils Survey Laurens and Union Counties, South Carolina (now being printed), USDA, Soil Conservation Service.
- ^{2/} Flood plain soils. Cartecary is moderately well to somewhat poorly drained. All other soils are well drained.
- ^{3/} Has fragipan.
- ^{4/} Has high shrink-swell characteristic.
- ^{5/} USDA, op. cit.

Classes II and III include those soils suitable for annual or periodic cultivation of row crops. Capability Class IV includes those soils on which cultivation should be undertaken only occasionally or under very careful management. Capability Classes VI and VII include those soils considered unsuitable for cultivation of row crops, but can be used for pasture, forest, or wildlife plantings.

The bedrock within the watershed consists of schist, granite, and gneiss. Belts of these materials traverse the watershed in an east-west direction. They are named from north to south - The Inner Piedmont Belt, The Kings Mountain Belt, and The Charlotte Belt. The ages for most of these rock Units are subject to many varied geologic interpretations. Overstreet and Bell^{1/} assign their ages as: Schist, Upper Precambrian to Mississippian Ages; Granite, Ordovician to Permian Ages; and Gneiss, Precambrian to Devonian Ages.

There are possible commercial deposits of vermiculite and granite in the watershed, but none are being mined at present. Crushed granite and deposits of vermiculite are being mined in upland areas east of the watershed near Laurens^{2/}.

Ground water is the main source of supply for rural residents. Weathered areas in the granites and schists are the aquifers for most watershed wells. Maximum consumption data from sampled watershed wells, their chemical analyses, and state drinking water standards are shown in Tables 8 and 12.

The watershed is within the northwest climatic division of the state. The topography is highly dissected with elevations ranging from 850 ft. msl., near Fountain Inn to 430 ft. msl., at Lake Greenwood. The average annual precipitation is 49 inches with 25 percent occurring in the spring, 26 percent in the summer, 21 percent in the fall, and 28 percent in the winter. Rainfall during the growing season is unevenly distributed and crops often suffer from lack of moisture. Most winters bring light snowfalls of two to six inches that stay on the ground for only a day or two. The average annual temperature is 62° F. The extreme recorded temperature ranges are 0° F and 107° F^{3/}. Growing seasons are long enough for crops such as cotton, soybeans, and corn to reach maturity. Winters are mild enough for fall planted small grain production. Cattle can endure the winter weather without shelter, but require some supplementary feeding of hay and grain during the coldest winter days.

Rabon Creek heads in Greenville County near Hopewell Church, Hillcrest

- ^{1/} Overstreet, W.C., and Bell, H., III, The Crystalline Rocks of South Carolina, Geological Survey Bulletin 1183, 1965.
- ^{2/} South Carolina Mineral Producers Directory, South Carolina State Development Board, Circular 2, 1972.
- ^{3/} The Climate of South Carolina, Climatic Series No. 1, Department of Agronomy and Soils, South Carolina Agricultural Experiment Station, Clemson Agricultural College, July 1958.

School, and Fountain Inn. The upper portion is made up of two major tributaries. North Rabon Creek, beginning as Stoddard Creek, runs in a southward direction as it is joined by Mountain Creek, Lick Creek and numerous smaller streams to its confluence with South Rabon Creek near State Highway 252. South Rabon Creek heads in Greenville County and is joined by Payne Branch near the county line. It then flows south, picking up small branches, and joins North Rabon Creek. These streams form Rabon Creek which continues its southward flow to Lake Greenwood, which has a surface area of 11,400 acres. The streams named above are perennial. Field and map surveys indicate that there are 200 miles of perennial streams within the watershed. Characteristics at selected points along the perennial streams are shown in Table 9.

Perennial streams are supported by approximately 350 miles of intermittent streams. The intermittent streams generally flow during wet weather, but become dry during late summer and early fall. A field survey of selected areas within the watershed, indicates that a drainage area of approximately 300 acres with three to five miles of ephemeral drainageways is needed to originate an intermittent stream.

Rabon Creek is classified by the South Carolina Department of Health and Environmental Control as a Class "B" stream^{1/}. This classification is assigned to a stream after a public hearing as being the stream quality desired. The actual stream quality may be better or worse than the classification assigned. The current state policy is to improve all stream quality. After a classification is selected, then it becomes law that nothing can be done to lower the water quality below the assigned value. A Class "B" stream has the standard of being suitable for municipal and recreational purposes, excluding swimming. (See Table 11.) The city of Laurens is presently obtaining raw water from Reedy Fork of Little River and from Rabon Creek. For raw surface water quality at selected points in the watershed, see Table 10.

There are an estimated 60 farm ponds within the watershed. The average size of these ponds is five to six acres. These ponds usually hold water throughout the year and furnish water for livestock, fishing, and limited irrigation. There are no lakes of significance within the watershed.

Economic Data

The Public Works Commission of the city of Laurens owns about 170 acres of land at its pumping station on Rabon Creek. The remaining area is in private ownership. Industrial timber companies own about 3,000 acres of forest land.

Types of farms range from the small part-time farming units to larger full-time family-sized units. There are about 250 farms in the

^{1/} Stream Classifications for the State of South Carolina, South Carolina Department of Health and Environmental Control, 1972.

watershed with an average size of 200 acres. In addition, there are about 400 small tracts used primarily as rural homesites. The value of upland, largely dependent upon location, ranges from \$200 to more than \$2,000 per acre along major roads and near towns. Flood plain land values range from \$150 to \$800 per acre. The average farm value is about \$65,000.

The land is presently being used as follows:

Land Use	Total Watershed		Flood Plain	
	Acres	Percent	Acres	Percent
Crops	11,100	13	130	2
Pastures	15,400	18	1,680	26
Forests	53,000	62	4,400	69
Other Uses	6,000	7	190	3

Principal crops grown are cotton, small grain, corn, grain sorghum, and soybeans. Beef cattle, dairy and poultry enterprises are also important. In recent years, the production of livestock, grain sorghum, and soybeans have increased, while cotton and small grain acres have decreased. Average yields for major crops are as follows:

Crops or Grasses	Unit	Yield	
		Upland	Bottom land
Cotton	Acre	400 lbs.	N/A
Soybeans	Acre	25 bu.	35 bu.
Corn	Acre	65 bu.	90 bu.
All Hay	Acre	1.3 tons	2.8 tons
Pasture	Acre	3 AUM*	5 AUM*

The forests are about 90 percent well stocked with merchantable tree species. Average per acre volumes are as follows: pine sawtimber, 990 board feet; hardwood sawtimber, 157 board feet; pine pulpwood, 454 cubic feet; and hardwood pulpwood, 160 cubic feet.

An excellent network of roads link the watershed with markets in Laurens, Greenville, Anderson, and Columbia. U.S. Highways 76 and 276, numerous primary and secondary highways, and the Seaboard Coast Line Railroad serve the area. Interstate Highways 26 and 85 are within 10 miles of the watershed. Almost all of the roads are paved. Most of the rural homes are built along the roads and accessibility is no problem.

Family incomes in the area are derived mainly from textile manufacturing, agriculture, and supporting activities. Manufacturing plants in Greenville and Laurens and along U.S. Highway 276 furnish off-farm employment and employ approximately one-third of the watershed farmers

* Animal Unit Month.

that are classified as part-time. During recent years, many new homes have been built and occupied by families whose incomes are from off-farm employment. Approximately 84 percent of the commercial farms of the watershed have total value of sales of less than \$10,000. Few farms employ full time labor, but some seasonal labor and custom work are utilized. The annual unemployment rate of Laurens County was 4.2 percent for 1972.

The state is divided into ten planning regions. Laurens County is under the Upper Savannah Regional Planning and Development Council, and Greenville County is under the South Carolina Appalachian Council of Governments. Greenville County was designated as a part of the region with high unemployment and underemployment by the Appalachian Regional Development Act of 1965. Laurens County is in the Upper Savannah Economic Development District, which was organized in 1968 under the Economic Development Act of 1965. Laurens County is a part of the Ninety-Six Resource Conservation and Development Project, which is authorized for planning.

There is considerable potential for promoting community development in this watershed through improved land use and development of water resources. A substantial increase in average farm income as well as off-farm job opportunities are needed before this area can compete favorably with other parts of the state and nation.

Fish and Wildlife Resources

The use of the stream fishery resource by fishermen is almost entirely confined to the lowermost three miles of Rabon Creek. All streams in the watershed support a warm water fishery, but fishing pressure in these three miles is seasonally high but overall is considered light. Tributaries and the upper half of the main stem of Rabon Creek are classified as dace trickles, while the lower half of the main stem is classified as a sucker stream^{1/}. Above the tributary Dirty Creek, the stream flow is shallow, the channel is filled with sand, and holes with enough water depth to provide fish habitat are rare. Except for immediately adjacent to State Highway 76 crossings, there is no evidence of fishermen use of either North or South Rabon Creeks. Lake Greenwood, at the watershed outlet, provides excellent fishing for largemouth bass, white bass, sunfish, catfish, and pickerel. During the spring months there is a migration of crappie, largemouth bass, and white bass from Lake Greenwood as far as three miles upstream in Rabon Creek.

A study was made of macrobenthic organisms in a 12 mile reach of Rabon Creek from Mill Rock to State Highway 54 crossing. Sampling stations were approximately two miles apart.

The algal substrate attached to Mill Rock supports a macrobenthic fauna principally composed of Ephemeroptera, Diptera, Planaria, and

^{1/} U.S. Department of the Interior, Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, Atlanta, Georgia (letter dated June 5, 1970).

Simulium. In the gravel riffle immediately below Mill Rock, the same forms were collected with the exception of Simulium. No macrobenthic fauna was found at any of the other sampling stations. The constantly shifting sand bottom that exists throughout most of Rabon Creek is apparently a hostile environment for macrobenthic animals. Since macrobenthic animals are important links in the food chain of fish and other aquatic vertebrates, fish populations of Rabon Creek will, of necessity, be low.

Wildlife habitat consists of bottom land hardwoods, wooded uplands, abandoned fields, and agricultural lands supporting such species as deer, squirrel, bobwhite quail, and rabbit. Hunting pressure is low to moderate. Bottom land hardwoods provide the highest value habitat in the watershed for deer. Mast from sweetgum and water oak in these bottom land hardwoods contribute to the food supply of upland species such as quail. Wildlife den trees are more common in oaks than the other tree species. Cavities suitable for wood duck nesting are rare.

Wildlife species observed in potential impoundment sites were white-eyed vireo, red-eyed vireo, tufted titmouse, flicker, yellow-billed cuckoo, blue jay, downy woodpecker, blue-gray gnatcatcher, yellow-breasted chat, cardinal, chickadee, belted kingfisher, Carolina wren, wood peewee, and yellowthroat. The most numerous winter birds indigenous to this kind of habitat are several species of sparrows. The wood duck population is low, and other waterfowl species are absent in this watershed because of lack of suitable wetlands. It is possible a low population of woodcock is present during the winter months.

There has been a gradual increase in the number of deer and wild turkey during the last 15 years, and huntable populations now exist. Conversion of upland fields to forests contributes to favorable conditions for deer and wild turkey.

The number of other kinds of wildlife in the flood plains is limited because of the type of habitat. There is a fair to good population of gray squirrel and opossum and a low population of raccoon. There is a high population of chipmunks along the upland edges of the flood plain.

No species on the current list of endangered wildlife species are known to occur in the watershed. It is possible, on rare occasions, that a peregrine falcon could be a temporary winter visitor.

About one half of the watershed is in the Central Piedmont Hunt Unit. There are 22 game management areas within the watershed consisting of approximately 10,000 acres which have increased the wildlife population in the watershed. Deer and wild turkey hunting are allowed in these game management areas. Hunting in these areas requires the purchase of a permit in addition to the regular hunting license. Game management area regulations are enforced in this area.

Recreational Resources

Recreational resources within the watershed include fishing, hunting, horseback riding, and private or church associated picnic areas. The rock shoal near Mill Rock Church in the central section of the watershed

is a locally popular recreation area for wading and picnicking. Farm ponds furnish some water-based recreational opportunities, primarily fishing. Lake Greenwood located just south of the watershed provides good boating, fishing and water skiing opportunities. The nearest state parks are Paris Mountain, Greenwood, and Croft, each of which is located some 40 miles from the watershed. Part of the Sumter National Forest is about 25 miles west.

Archeological and Historical Values

One historic site within the Rabon Creek Watershed is listed in the National Register of Historic Places^{1/}. It is the Sullivan House, in Laurens County, located on State Highway 54. Several possible archeological sites were located during the watershed reconnaissance and in consultation with the Institute of Archeology and Anthropology, University of South Carolina. The Institute investigated these sites and their findings are given in the "Works of Improvement" section of the work plan.

Soil, Water and Plant Management Status

During the last 20 years, there has been a 60 percent reduction in the acres of cotton produced in the watershed. Cotton has been replaced by soybeans, pastures, and grain sorghum. Some of the more eroded fields have been planted to pine trees. A shift from tenant-operated farms has resulted in some larger, more efficient units with specialities in cattle or row crop operations. This is reflected in the following data:

Average Size of Farm and Percent Change; and
Average Number of Farm Tenants and Percent Tenancy ^{2/}

County	-----Acres-----			% Change 1964-1969	Tenants (No.)		% Change 1964-1969
	1959	1964	1969		1964	1969	
Laurens	150	179	235	31	202	33	-84
Greenville	77	89	103	15	161	55	-66

Even though most tenant operations have disappeared, there still remain numerous farm operations where equipment and labor are being employed on land where returns are marginal. These problems stem from small acreages, soil erosion, and flooding of bottom land.

^{1/} National Register of Historic Places, approved for publication in the Federal Register, U.S. Department of the Interior, National Park Service, June 22, 1973.

^{2/} Selected Census of Agriculture Characteristics, South Carolina 1959-1969.

The South Carolina Commission of Forestry, in cooperation with the U.S. Forest Service, through the various federal-state cooperative forestry programs, is providing forest management assistance, forest fire protection, and suppression, distribution of planting stock and forest pest control assistance to private landowners in the watershed.

Loan funds are available to eligible landowners through the Farmers Home Administration (FmHA) for helping to finance soil and water conservation practices. The Cooperative Extension Service of Clemson University, through county agricultural extension agents, is assisting with information and educational programs to carry out project objectives. The Agricultural Stabilization and Conservation Service administers the Rural Environmental Conservation Program which provides cost sharing assistance to qualified landowners for erosion and sediment control practices and improved forest management.

Two soil and water conservation districts serve the watershed. The Greenville County and Laurens Soil and Water Conservation Districts have active programs that encourage the planning and application of conservation measures. Other activities of the districts include cooperative seed purchase for soil conserving grasses, ownership of equipment for installing conservation practices, educational programs, demonstrations, and outdoor classrooms. Both districts have sponsored other watershed projects. Two field offices of the Soil Conservation Service assist the soil and water conservation districts.

Two hundred fifteen landowners and operators are active cooperators with the soil and water conservation districts. One hundred eighty-five of these cooperators have soil and water conservation plans covering approximately 41,000 acres or about one-half the watershed. Approximately 55 percent of the planned land treatment practices have been applied, and 45 percent of the watershed lands are adequately protected from erosion. Soil surveys have been completed for the watershed.

WATER AND RELATED LAND RESOURCE PROBLEMS

Land Treatment

Freezing and thawing of soils causes heaving on some areas and result in loss of vegetative cover. Some of the soils are subject to gully erosion when runoff water is concentrated. Undesirable vegetation has choked out improved grasses in some pastures and renovation is needed. Critically eroding areas are found in all land uses and need special treatment. Fields with conventional terrace systems need to be smoothed and new water disposal systems, including grassed waterways and parallel terraces, need to be established. Some fields with serious erosion problems need to be farmed by improved methods such as no-till planting or grass based rotations. Marginal units need to change to some other type enterprises.

Approximately 25 percent of the 11,100 acres of watershed upland currently in row crops is in land capability Classes IIIe and IVe (generally

slopes from 8 to 15 percent). Farmers cultivating these areas often ignore the drainage patterns and contours of the fields causing serious erosion problems. Special handling of these areas through a combination of cultural and/or mechanical practices is needed for protection of these lands from erosion if cropping is to be continued. At least 1,500 acres of land in Capability Classes IVe and VIe now idle or being used for crops should be planted to grasses or trees because of the erosion problems.

Most farmers in the watershed do not have the financial ability to install the needed land treatment measures without assistance.

Problems in forest land are generally due due to a lack of multiple use management that would provide watershed protection as well as economic and environmental benefits. Scrub or weed trees encroach on the production of more desirable species. Landowners are not harvesting timber on regular schedules. The greatest need of the small forest owner is technical assistance in conservation planning, marking, and marketing timber, removal of scrub or weed trees, planting or interplanting seedlings, and constructing forest access roads and firebreaks. The average annual fire loss index in the watershed for the past 10 years was 0.18 percent. This is within the state goal of 0.25 percent and within the watershed protection goal of 0.20 percent. The South Carolina Commission of Forestry's fire protection and suppression organization in both counties is adequate to cover the fire protection needs of the watershed.

Floodwater Damage

There are 6,400 acres of land in the watershed that are subject to flooding. This flood plain land is along Rabon Creek, North Rabon Creek, South Rabon Creek and their tributaries. More than one-half of the flood plain once used for crops has reverted to less intensive use or is idle. Flood damage to existing crops and pastures causes increased production and maintenance costs, hampers good management practices, and prevents intensive use of much of the flood plain. About 130 acres of flood plain are presently used for crops. A few acres are devoted to truck crops, but most of this area is used for corn and soybeans. There are 1,680 acres used for pastures and hay. About half of this area is of high quality improved grass and the remainder is in native grasses with some brush and tree encroachment. About 190 acres of flood plain land are in roads and utility rights-of-way. The remaining 4,400 acres of the flood plain are in forest. All of the flood plain land is in small private ownership, except for about 300 acres in industrial forest land. No businesses or homes are located in the flood plain.

About 3,500 acres are flooded annually. Some areas, particularly in the lower half of the watershed, flood several times per year. About one-third of the floods occur during the crop growing season. Most of the damage to crops and pastures is caused by floods which occur on the average of once every two years or more often. These frequent floods prevent the planting, cultivation, or harvest of crops, cause loss by drowning of crops, and loss of grazing days by deposits of sediment on

grass and wet soil conditions.

Large, infrequent floods cause flood plain erosion and greater sediment deposits as well as major road and bridge damage. Since most of the damageable values are crops and pastures, average annual damages by larger, less frequent floods are not as great as those caused by the smaller, more frequent ones.

Land values in the watershed are increasing rapidly (50 percent to 75 percent in the last five years). Farmers are not able to purchase productive uplands to expand their operations or to replace land lost to homesites or industries. Recent changes and projections indicate that expansion of grassland farming enterprises will take place on the flood plain. Future land use projections indicate that much of the flood plain land will be used for pastures and feed crops as this area is well suited for the production of beef cattle.

Presently, most of the row crops in the flood plain are above State Highway 101. Pastures are found throughout the flood plain. Much of the flood plain land below U.S. Highway 76 has severe floodwater and sediment problems and is used less intensively.

Average annual crop and pasture damages are estimated to be \$18,100. Other agricultural damages including forest, fences, machinery, cattle losses, sheds, farm roads, and other improvements are estimated to total \$4,700 each year. Nonagricultural damages in the form of scoured road surfaces, erosion of bridge abutments, bridge and culvert washouts, and damages to other properties total \$5,400 annually.

Loss of income from reduced crop production, increased cost of replacement and repairs, and the threat to the health and safety of people, tend to cause the standard of living to be lowered. Incentives to improve the environmental condition are reduced by frequent losses from flooding.

Erosion Damages

Measured in total tons of soil loss, the greatest contributor is sheet and rill erosion from cultivated fields. On about half of the approximately 11,100 acres of cropland in the watershed, erosion rates exceed the tolerable limit of about four tons per acre per year. The most severely eroding cultivated fields often lose as much as 18 tons per acre per year. Erosion from pastures and forests is much less, however, some are eroding to an excessive degree.

The most severe erosion is limited to isolated critical areas such as galled field areas, road cuts, dirt roads, borrow areas, field borders, and gullies. Some of these areas produce as much as 80 tons per acre per year. Field areas with severe problems make up the largest part of this critical area with 333 acres. Critically eroding areas in forests are estimated to be 90 acres. Fifteen acres of dirt roads and road cuts are classed as critical. Eighteen critically eroding gullies (27 acres) have been identified. Flood plain scour is minor and results in average annual damage of only \$300.

The erosion problem within the watershed has been declining due to the conversion of cultivated land to pasture and forest. The general

outlook is for erosion to increase as a result of expected urbanization. This would include erosion from construction sites for homes and access roads.

The long range effects of erosion are a decrease in soil fertility and tilth, reduction of crop yields, increase in farm production costs, and the build-up of off-site damages. This type of soil depletion will reduce farm income, degrade aesthetics, and lower living standards for all the people in the watershed.

Sediment Damage

In the uplands of the watershed, sediment damages are confined to terrace channels, road ditches, splays in field draws, and field borders. Over the years, these areas have amounted to several hundred acres. Although most of the areas recover with time, damages are evident. The largest annual expense is incurred by the road departments in maintaining road ditches.

On the flood plains above State Highway 101, moderate sediment damages occur in the form of localized splays. Entrained sediment three or more feet deep exists in channels from Lake Greenwood to State Highway 101 on North Rabon Creek and to the Greenville County line on South Rabon Creek. Loss of channel capacity increases flooding and resultant sediment damages.

Below State Highway 101 on South Rabon Creek to U.S. Highway 76, sediment and associated swamping damages are increasing. These damages, are in the form of overbank deposits, splays and dike induced swamps. Sediment damages are minor on the flood plain of North Rabon Creek between State Highway 101 and U.S. Highway 76.

The flood plains below U.S. Highway 76 along both North and South Rabon Creeks to their confluence have been damaged severely by deep sand deposits.

From the confluence of North and South Rabon Creeks, to the backwaters of Lake Greenwood, a defined channel exists. At present, with the exception of coarse grained sand deposits above and below bridge openings, sediment damages decrease downstream from the confluence.

Sediment deposits have damaged 1,162 acres of flood plain land to some extent. About 140 acres have been damaged severely. Approximately 575 acres have been damaged moderately. The remainder has been damaged slightly. Swamping resulting from sediment deposits along stream banks is causing damage to 100 acres mostly in the lowermost six miles of Rabon Creek. Swamping damages are evident in the loss of timber in the flood plain.

The estimated average annual sediment yield to Lake Greenwood is 93,000 tons or 58 acre feet. The average annual suspended sediment concentration approximately one mile from the watershed outlet is estimated to be 630 milligrams per liter. Annual suspended sediment concentration estimates for other locations are as follows: South Rabon Creek at Payne Branch junction, 570 mg/l; North Rabon Creek one mile north of State Highway 101, 480 mg/l; Rabon Creek at State Highway 252, 310 mg/l; Mountain Creek two miles southwest of Gray Court, 500 mg/l; and at

Dirty Creek three miles west of Maddens, 410 mg/l. Other damages caused by this concentration are to the fishery resource and the cost of removing sediment from the domestic and industrial water supply by the Laurens Public Works Commission.

Average annual sediment damages are estimated as follows: overbank deposition, \$5,400; swamping, \$300; and deposition in Lake Greenwood, \$46,400.

Municipal and Industrial Water

Increased population and industrial growth of the watershed and surrounding area has created a need for a dependable source of water. The city of Laurens ran short of water during the mid 1950's, when rainfall and stream flows were extremely low. In recent years, water use has been restricted for short periods. The lack of a dependable water source has prevented industries from locating in the area.

The rural residents of Laurens County and part of Greenville County have organized into a rural water district and are planning to install water lines throughout most of Laurens County. The city of Laurens' present water supply system has a pumping capacity of four million gallons per day and a filtering capacity of five m.g.d. The peak use rate by the city in 1971 was 2.5 m.g.d. A rural water system to be installed and operational in 1976 will require an additional 0.75 m.g.d. The total projected demand on the system by 1976 is five m.g.d.

Seventy percent of the raw water supply is obtained from Rabon Creek with the remaining 30 percent being pumped from Little River in normal seasons. During periods of drought, Little River has little or no flow and all of the water is obtained from Rabon Creek.

Within Laurens County, two floodwater retarding structures which include storage for municipal and industrial water are planned. One is a structure in Beaverdam-Warrior Creeks Watershed project having a potential to provide 2.1 m.g.d., and the other is a structure on Reedy Fork Creek, a tributary of Little River with a potential of providing 1.2 m.g.d. By the year 2000, it is anticipated that the population of Laurens County will increase from its current level of 49,700 to 76,000. This increase in population and expected industrial growth will create a demand for 20 million gallons of water per day^{1/}.

Recreation

As described in the "Watershed Resources - Environmental Setting" section, water in Rabon Creek is presently classified as unsuited for contact sports such as swimming and skiing. Also, during normal summer months, potential swimming areas are widely scattered, small, and mostly

^{1/} Population projections were made during the Santee River Basin Study. Water demands were estimated by the Upper Savannah Regional Planning and Development Council, and the engineering firm assisting the Laurens County Water Resources Commission.

inaccessible. Suspended sediment in most of the ponds discourages the use of the water for recreation. Lake Greenwood is available for public use, but facilities and access are limited.

The population within 50 miles of the watershed is 750,000, which represents a significant demand for recreation. The Laurens County Water Resources Commission is interested in developing water based recreational facilities. The Laurens County Legislative Delegation has expressed support for improving recreational opportunities. The soil and water conservation district commissioners in both districts have, as one of their objectives, the improvement of recreational opportunities. The Greenville County Recreation Commission has expressed some interest in developing recreational areas in the southern part of Greenville County. The statewide Comprehensive Outdoor Recreation Plan^{1/} identified a need for a state park in the general vicinity of the Rabon Creek Watershed. Laurens County has no state park or any substantial public recreational areas at present. The population of the general area is increasing faster than the state average. There is a definite need for a water based recreation development in this area.

Fish and Wildlife

Habitat for some wildlife species has been altered through the conversion of open land, idle land, or hardwood forest to solid plantings of pine. Also, some flood plain hardwood sites have been cleared for pasture resulting in a loss of this type of wildlife habitat.

Sediment deposits in streams have damaged fish habitat by filling holes and causing shallow flows. In some areas, the stream fishery has been eliminated by sediment deposits. Lake fishing opportunities within the watershed are limited. Even though Lake Greenwood is close by, the demand for lake fishing by the year 2000 will far exceed the supply. If the demand for hunting opportunities in the future is to be met, a concentrated effort will have to be made to improve and develop wildlife habitat. This is especially true for quail hunting opportunities.

Economic and Social

About 84 percent of the commercial farms are low producing units with annual sales less than \$10,000. Farm incomes are lower, on the average, than non-farm incomes. The average annual rate of unemployment in Laurens County has been higher than the state average for the past several years. Listed below are averages for the county and state for the years 1967

^{1/} SCORP-70, South Carolina Department of Parks, Recreation and Tourism, Columbia, South Carolina, 1970.

through 1972:

Average Annual Unemployment Rate
for Laurens County and South Carolina, 1967 - 1972

Year	Laurens County (percent)	South Carolina (percent)
1967	5.1	4.7
1968	4.7	4.3
1969	4.0	3.9
1970	5.9	5.0
1971	5.7	5.2
1972	4.2	4.1

SOURCE: South Carolina Employment Security Commission

Underemployment is a problem due to farm sizes and efficiency of farming operations. Additional off-farm jobs are needed to absorb the underemployed farm workers. Ninety percent of the owners of flood plain land operate family type or part-time farms.

Water Quality Problems

Water quality of all sources is adequate, with proper treatment. Rabon Creek was classified by the South Carolina Department of Health and Environmental Control as a "B" stream. This classification is suitable for municipal water supply. The Beattie Plant of Woodside Mills at Fountain Inn has a permit to discharge 20,000 gallons per day of treated waste into Payne Creek. There are no known sources of untreated wastes entering the stream.

PROJECTS OF OTHER AGENCIES

There are no known projects which will be adversely affected by the works of improvement in this plan.

Lake Greenwood, owned by the Greenwood County Electric Power Commission, is located on the Saluda River and is used for hydroelectric power and recreation. Construction was begun in 1940. The total drainage area is 1,150 square miles. The planned minimum capacity of the structure is 270,000 acre feet.

The U.S. Army Corps of Engineers is planning a flood control, recreation, and municipal water storage structure on Reedy Fork Creek at Laurens.

PROJECT FORMULATION

Formulation of the project was closely coordinated with officials and individuals representing the following: Rabon Creek Watershed Conservation District, Greenville County and Laurens Soil and Water Conservation Districts, Laurens Public Works Commission, the Upper Savannah Regional Planning and Development Council, the Laurens County Water Resources Commission, the U.S. Fish and Wildlife Service, the South Carolina Wildlife and Marine Resources Department, the Institute of Archeology and Anthropology at the University of South Carolina, Rabon Creek Water District, the South Carolina Department of Parks, Recreation and Tourism, and other organizations and individuals.

Soil and water conservation district commissioners set goals and planned the land treatment program. The watershed directors, with the assistance of USDA personnel, located problem areas and set flood reduction objectives. Officials of the Laurens Public Works Commission, the Rabon Creek Water District, and the Laurens County Water Resources Commission, and engineering firms employed by these organizations, assisted with the planning for municipal and industrial water storage.

Representatives of the Greenville County Recreation Commission, the Laurens County Water Resources Commission and other organizations planned for recreational development in the watershed. The South Carolina Department of Parks, Recreation and Tourism and the consulting engineers assisted in the design and layout of the two recreational areas.

Environmental issues were considered throughout the planning of the project. The South Carolina Wildlife and Marine Resources Department, the U.S. Fish and Wildlife Service, and the Institute of Archeology and Anthropology at the University of South Carolina assisted in environmental studies.

Several public meetings were held during planning. Notices of these meetings were made public in the local newspaper and on the local radio station.

The Upper Savannah Regional Planning and Development Council has taken an active role in project formulation, especially in planning for water supply and recreation. The South Carolina Appalachian Council of Governments reviewed and commented on proposals. The Santee River Basin Report^{1/} includes the Rabon Creek Watershed Project in the recommended Early Action Plan.

Objectives

The objectives are to improve the economic and environmental conditions of the community through water and related land resource conservation and development. More specific objectives developed during planning by the

^{1/} USDA River Basin Report, USDA, Soil Conservation Service, Columbia, South Carolina, September 1973.

sponsoring local organizations and agreed to by the Service are as follows:

1. To provide watershed protection that will reduce erosion and bring soil loss to within tolerable limits. These limits are considered to be four tons per acre per year on cropland and two tons per acre per year on pasture and forest land.
2. To provide flood protection to the degree that most of the flood plain land can be used for improved pasture.
3. To reduce sediment to Lake Greenwood.
4. To enhance water based recreational opportunities by providing such activities as fishing, picnicking, boating, sight-seeing, and nature studies with a design capacity of 500 people.
5. To provide a dependable source of water to meet present and future needs for a population of 76,000 people by the year 2000.

Environmental Considerations

In developing this plan, investigations were made as to the impact of the project on any environmental issue or concern that was identified. An investigation was made to determine archeological values by representatives of the Institute of Anthropology and Archeology, University of South Carolina.

Recreational facilities compatible with the water quality and the health and safety of the user are necessary to realize the expected benefits.

The downstream effect on stream flow and quality of water has been analyzed to identify the impact and resulting changes to be expected.

The permanent commitment of resources was evaluated with each alternative considered. Losses of each resource were identified and evaluated in relation to the total amount of that resource.

The displacement of people, businesses, or farm operations because of structural measures was considered.

Methods of avoiding air, water, and noise pollution were included in project formulation.

Alternatives

The reasonable alternatives to the proposed project action which have been considered include: (1) accelerated land treatment, (2) land treatment, a multiple purpose site for flood prevention, municipal and industrial water and recreation, and channel work on North and South Rabon Creeks, (3) land treatment, channel work, municipal and industrial water from Lake Greenwood, and stream side recreation, (4) land treatment,

flood proofing, land use compatible with present flooding, and municipal and industrial water from Lake Greenwood, and (5) no project.

The alternative of accelerated land treatment consists of those practices and measures described under "Works of Improvement to be Installed - Land Treatment Measures". Although this alternate would have little or no adverse effects, only minor benefits to the problem areas would be realized. Flood damages would be reduced approximately three percent initially. Channels in the watershed would continue to lose capacity and farmers would eventually be forced to abandon the flood plain entirely to brush and trees. Many of the farmers in the watershed need to use the flood plain land to make their farms economical units. Municipal and industrial water supply and recreational water needs would not be satisfied. Cost of this alternate is estimated to be \$754,000.

Land treatment, a multiple purpose structure for flood prevention, municipal and industrial water and recreation, and channel work on North and South Rabon Creeks were considered as an alternative. The average gradient of both North and South Rabon Creeks is about 15 feet per mile. Construction of a stable channel in the soils found in the flood plains on this grade would require numerous grade control structures. Channel enlargement would require 436 acres of flood plain land. All of the channel has tree growth on both banks which would be destroyed. This alternative was estimated to cost \$4,100,000 and would require 1,430 acres.

Another alternative considered was land treatment, channel work, municipal and industrial water from Lake Greenwood, and stream side recreation. This alternate would not reduce the sediment being delivered to Lake Greenwood. Stream side recreation possibilities were studied, but due to limited stream flow during dry times this was judged to be impractical. Obtaining municipal and industrial water from Lake Greenwood would necessitate the construction of a pipeline at an estimated cost of \$4,000,000. Pumping costs and right-of-way requirements for the pipeline would be much greater than if the water is obtained from a structure on Rabon Creek. Channel enlargement would require 1,012 acres, of which more than half is bottom land hardwoods. This alternate was estimated to cost \$7,000,000.

The alternative of land treatment, flood proofing, land use compatible with present flooding, and municipal and industrial water from Lake Greenwood was considered. Stream side recreation was not considered in this alternate, because of the extreme flood hazard and low flows during dry periods. This alternate differs from the previous one, in that no flood reduction is included and will necessitate land use restrictions to minimize damages. There are no existing authorities to implement land use restrictions in the watershed. The only reasonable use of the flood plain which would be compatible with present flooding is woodland, which as stated in the first alternate would not fit the farm operations in the watershed. Roads and bridges are the only fixed improvements in the flood plain. Flood proofing would necessitate enlarging bridge openings, raising or relocating roads, and/or riprapping. The total cost of this alternate was estimated to be \$6,000,000.

The alternative of no project would not relieve any of the existing

problems in the watershed, and damages would increase as channels continue to fill with sediment. Municipal and industrial water supply and recreation needs would not be satisfied. This would result in continued out-migration, unemployment and increased social problems. The net average annual benefit foregone if this alternate was chosen is \$146,500.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

Conservation treatment systems will be installed on 2,400 acres of cropland scattered throughout the watershed during the project installation period reducing soil loss to within tolerable limits. At least two systems of treatment will be used. These systems are as follows:

System 1: A combination of terraces, grassed waterways, field borders, land leveling, stripcropping, contour farming, and conservation cropping systems.

System 2: A combination of grassed waterways, field borders, land leveling, contour farming, conservation cropping systems, and no-till planting.

All of the practices in System 1 and System 2 can be used together and with excellent results for conservation farming, but the land's capabilities will govern what practices should be employed and in what combination. The practices used in the two systems are defined in the following:

Grassed waterway: A natural or constructed waterway or outlet shaped and established in suitable vegetation as needed for the safe disposal of runoff from a field, diversion, terrace, or other structure.

Terraces: A ridge or channel constructed across the slope at a suitable spacing and with an acceptable grade.

Field borders: A border of perennial vegetation established at the edge of a field by planting or by converting it from trees to herbaceous vegetation or shrubs.

Contour farming: The planting of row crops horizontally across the slope of the land so as to reduce runoff and soil erosion.

Stripcropping: Growing crops in a systematic arrangement of strips or bands to reduce water erosion.

Conservation cropping systems (crop rotation): The growing of different crops in a regular succession usually alternating row crops with erosion resistant cover crops.

No-till planting: The planting of crops with no prior tilling or any post planting cultivation.

Land smoothing: Removing irregularities on the land surface by use of special equipment.

Other areas will receive partial treatment. Critically eroding cropland will receive special treatment during the installation period by the establishment of permanent grasses.

On pastureland, the major treatment system will include smoothing the land and pulling down and smoothing old terraces by special equipment, removal of undesirable forage and weeds by mechanical cutting and applying selected herbicides, planting improved grasses and legumes, and a complete fertilization and liming program based on soil tests and treatment needs. Cross fencing will be installed where deemed necessary. During the installation period, an estimated 3,300 acres of pastureland will be adequately treated and additional areas will receive partial treatment.

On forest land, conservation practices will be installed that will improve hydrologic conditions. By manipulating stand compositions that create favorable conditions for the maximum production and protection of litter and humus, a protective cover and an absorbent forest floor will develop. These practices will reduce runoff and erosion and will, therefore, reduce damages to the flood plains below.

Measures that create these favorable conditions include tree planting, timber stand improvement, thinnings, and protection of the forest floor from livestock grazing and wild fires.

To provide for proper installation and maintenance of these measures, forest management plans will be prepared and included as a part of conservation plans for 125 landowners, covering 8,000 acres.

Forest measures to be installed during the installation period include 1,000 acres of tree planting, 11,900 acres of hydrologic stand improvement, and the stabilization of 90 acres of critically eroding forest land.

Treatment to be installed on land in other uses includes erosion control practices of mulching and establishing grasses, planting of trees, and planting of grasses and shrubs which will also provide wildlife food and cover on about 500 acres including such areas as construction sites, school grounds, roads, and borrow areas. In addition, special treatment such as sloping roadbanks, mulching, and establishing grasses will be provided to stabilize 15 acres of critically eroding county roads.

Included in the plan are practices for the improvement of fish and wildlife habitat and recreational areas. Wildlife habitat improvement will consist of food and cover plantings and management on approximately 300 acres of land that were formerly borrow areas, idle land, and field edges. Fish habitat improvement will include fish pond stocking and the

development of lake fishery resources. Recreational areas will receive practices of establishing grasses, planting of selected trees and shrubs, and trimming and thinning of existing stands of trees and shrubs for recreational and aesthetic improvement.

The planned land treatment in the watershed will also change the present land use for optimum conservation of the resources. During the installation period, approximately 300 acres will be taken out of cultivation and established in pasture; 1,000 acres of idle land will be used to suit its capability in either cropland, pastureland, trees, or wildlife habitat.

Structural Measures

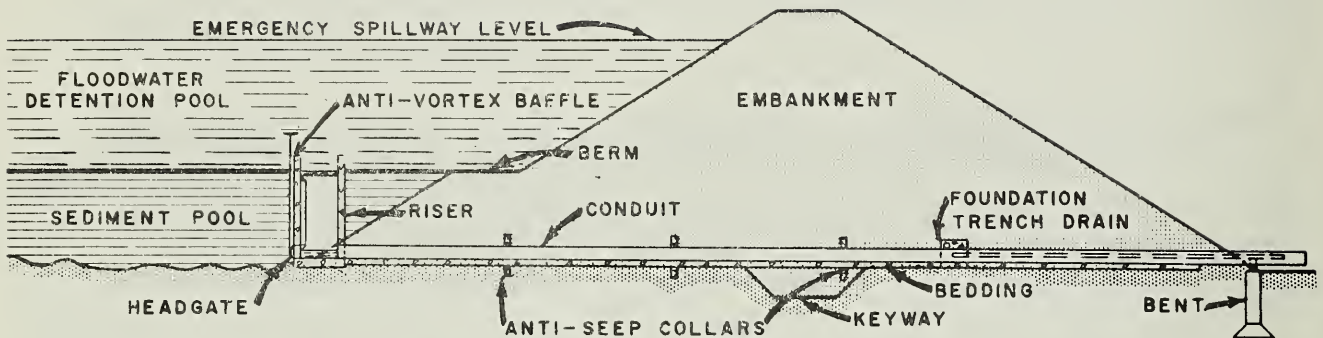
Structural measures to be installed consist of two single purpose structures for flood prevention (Sites 20 and 21) and one multiple purpose structure for flood prevention, water supply and recreation (Site 32). Two public access areas with recreation facilities are planned in conjunction with Site 32. The locations of structural measures are shown on the Project Map.

The total drainage area above structures is 59,514 acres, or about 70 percent of the watershed area. This includes 10,765 acres above Structure 20 and 8,781 acres above Structure 21.

All three structures will consist of earthfill embankments and reinforced concrete principal spillways located on yielding foundations. Structures will range from 45 to 57 feet in height and from 800 to 1,400 feet in length.

Principal spillways will consist of reinforced concrete risers on the upstream side of the structure with reinforced concrete pipes fitted with anti-seep collars placed through the embankments. The principal spillways of the single purpose structures, Structures 20 and 21, will outlet into excavated plunge basins. The plunge basins will be deep basins excavated at the end of the principal spillway pipes. Water flowing through the principal spillway plunges down into the pool dissipating much of its erosive energy. (See typical section of

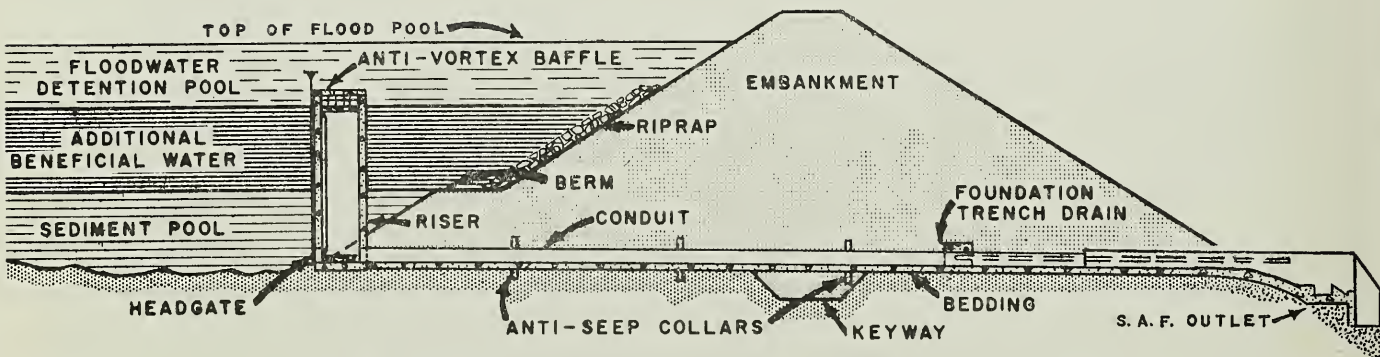
single purpose structure below.)



SECTION OF A TYPICAL FLOODWATER RETARDING STRUCTURE

(WITH SINGLE STAGE RISER)

The principal spillway of the multiple purpose structure, Structure 32, will outlet into a Saint Anthony Falls (SAF) type, energy dissipating basin. This basin creates a hydraulic jump, a turbulent, rapid rise in the water surface, which dissipates much of the water's erosive energy within the reinforced concrete structure. (See typical section of a multiple purpose structure below.)



SECTION OF A TYPICAL MULTIPLE PURPOSE STRUCTURE

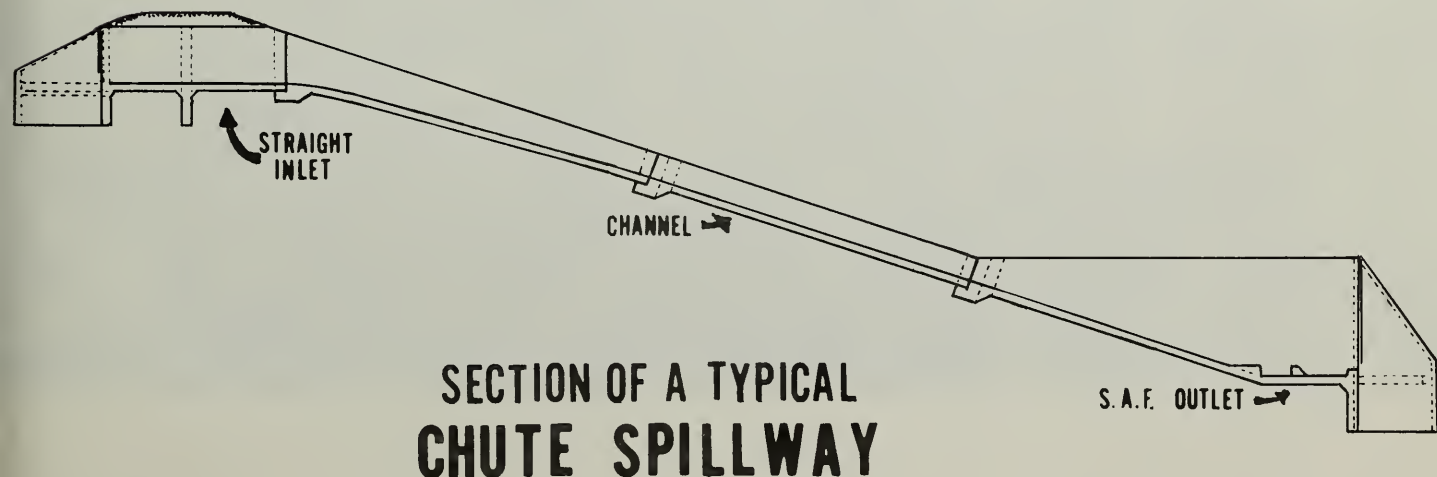
(WITH SINGLE STAGE RISER)

All structures are designed for an effective life of 100 years. The crest of the principal spillways of Structures 20 and 21 will be set at the 100 year sediment accumulation elevation. The crest of the principal spillway for Structure 32 will be set at an elevation to store the accumulated sediment over a 100 year period, 2,426 acre feet of municipal and industrial water, and 2,674 acre feet of recreation water.

The emergency spillways for Structures 20 and 21 will be constructed in earth and vegetated. Elevations for these spillways will be set at the 100 year frequency level and will have a one percent chance of operation in any year.

The low point of a saddle adjacent to the right abutment of Structure 21 is 3.5 feet lower than the emergency spillway elevation. A dike, approximately 430 feet in length, will be located in the saddle with its top elevation equal to that of the top of the dam.

Structure 32 will have a 150 foot wide reinforced concrete chute spillway on a yielding foundation at an elevation 7.5 feet above the principal spillway. This chute spillway will function as the second stage of the principal spillway and as the emergency spillway. All discharge from Site 32 will pass through the principal spillway or the chute spillway. The storage between the crest of the principal spillway and the crest of the chute spillway is the 40 percent chance runoff from its uncontrolled drainage area. Retarding storage in the reservoir reduces the two year frequency-24 hour duration storm peak discharge from the structure from 3,100 cubic feet per second (cfs) to approximately 800 cfs. It also reduces the 100 year frequency principal spillway design storm peak outflow from 14,600 cfs without the project to 7,720 cfs with the project structural measures. (See typical section of a chute spillway below.)



The embankment of Structure 32 will be constructed across the Rabon Creek valley and across a saddle adjacent to the right valley abutment. (See Site Location Map on the following page.) The principal spillway will be located in the saddle near the right end, looking downstream, of the centerline of the dam. The chute spillway will be located through the ridge which is the dam's left abutment. The upstream face of the embankment will be riprapped in the area subject to drawdown and wave action. A dike, approximately 300 feet long and four feet high will be constructed in a saddle southwest of the right end of the dam with its top elevation equal to the top of dam elevation.

Borrow material for construction of the structures will be obtained from the excavated spillways and other borrow areas near the proposed structures. Some of the borrow needed for Structures 20 and 21 and most of the borrow needed for Structure 32 is located above the top of dam elevation.

The sediment pools of Sites 20 and 21 will initially fill with water but will gradually be replaced with sediment during the 100 year life of the reservoirs. The sediment pools of Sites 20 and 21 and the normal pool of Site 32 plus a strip 15 feet horizontally from the water's edge will be cleared of woody vegetation as will construction areas for structure embankments, emergency spillways, the chute spillway, and borrow areas. The total area to be cleared is 827 acres, consisting of 776 acres in and adjacent to structure sediment and normal pool areas and 51 acres in construction areas for structure embankments, spillways, and borrow areas. No other land use changes will occur within the area.

Vegetation suitable to the soils, site conditions, and intended uses will be established on the embankments, exposed borrow areas, and on all disturbed areas associated with the chute spillway. On emergency spillway areas of Structures 20 and 21 and in the entrance channel leading to the chute spillway, the vegetation to be used will be bermuda grass. Grasses and/or legumes will be established on the embankments. Varieties of vegetation favorable to wildlife will be established in the exposed borrow areas. The cleared strip along the edge of the pools will revegetate itself in native vegetation.

Easements will be obtained to the top of dam elevation at Sites 20 and 21 and will include 715 acres. The Sponsoring Local Organizations will purchase about 1,154 acres at Site 32. This area includes 540 acres for the normal pool and 614 acres for the dam and spillway, borrow areas, a portion of the flood pool, and areas designated for recreation. Pool areas, up to the top of dam elevation, more than 200 feet upstream from the head of the normal pool in each arm of the reservoir (426 acres) were excluded from the area to be purchased and will be obtained by easements.

The 540 acre municipal and industrial water supply pool will be grubbed to improve initial water quality. Municipal water intake gates will be installed on the principal spillway riser to release water for pick-up approximately 2,000 feet downstream at the existing pumping station owned by the Public Works Commission of the city of Laurens.



SITE LOCATION MAP
STRUCTURE 32
RABON CREEK WATERSHED
GREENVILLE AND LAURENS COUNTIES
SOUTH CAROLINA

0 400 800

APPROX. SCALE - FEET

SCALE 1" = 400'

CONTOUR INTERVAL = 5'

Raw water will initially be pumped approximately seven miles to the existing water treatment plant owned by the Commission. Water will be sold by the Laurens County Water Resources Commission to the Public Works Commission of the cities of Laurens and Clinton, the Rabon Creek Water District, and other water districts for resale and distribution to the people of the county.

When future water needs grow to exceed the capacity of the existing treatment plant, the Laurens County Water Resources Commission is planning to construct a pumping platform adjacent to the reservoir with a water treatment plant nearby. The pumping platform and water treatment plant will not be needed for a number of years, and were therefore, not included as a part of this project.

One of the two recreational areas planned in conjunction with Site 32 will be located on North Rabon Creek and the other on South Rabon Creek. (See Project Map.) The North Rabon Creek area will be located approximately one and three-quarters miles upstream from Structure 32 and will be accessible by paved road from State Highway 76 and by dirt road from State Highway 252. The South Rabon Creek area will be located just downstream from the State Secondary Highway 312 bridge. The recreational areas will contain recreational facilities and will provide full public access to the reservoir and to the access strip around the reservoir. Facilities are shown on the Public Recreational Development Map and the Recreational Area Maps and are listed in Table 2B.

The recreational areas will contain paved access roads, parking areas for cars and boat trailers, boat ramps, picnic tables, cast iron grills, underground waste receptacle units, picnic shelters, foot trails, and comfort stations.

Paved roads and parking areas will consist of one and one-half inches of asphaltic surface over a six inch crushed stone base. The width of the paved surface will be 22 feet. All roads and parking areas will generally follow the contour. Grasses and/or legumes will be established on all cuts and fills. Drainage will be provided by collection ditches and culverts where necessary. A 45 foot precast reinforced concrete bridge will be needed at the North Rabon Creek recreational area.

The boat launching ramps will be constructed of 12 foot wide reinforced concrete logs. The double launching ramp will contain a combination divider strip and walkway made of reinforced concrete. The single ramp installation will include the divider strip as a walkway.

Picnic tables will be constructed with reinforced concrete uprights and wooden seats and table tops. Wooden picnic shelters will be approximately 20'x40' with a concrete floor.

A four unit (2+2) and a two unit (1+1) flush type comfort station will be located at each recreational access area. Septic tanks with disposal fields will be used to treat wastes. Soils are suitable for septic tanks. All sanitary facilities will be approved by appropriate federal, state, and local health authorities prior to installation.

Wells will be drilled at each recreational area to provide water for the comfort stations and hydrants. One pump is planned for each area.

Hydrants will be located adjacent to parking areas and boat launching ramps.

Foot trails will be constructed five feet wide and will be graded to provide a good hiking surface.

Electrical distribution lines will be installed to provide power for operating the water pumps and lighting for the comfort stations and parking areas.

Signs for identification and directions will be installed. Gates will be installed to control access. The areas will be landscaped as needed.

All planned structural measures will meet the requirements of local and state health laws.

The facilities will be designed and constructed to assure accessibility and usability by physically handicapped people in accordance with Public Law 90-480.

Land areas to be committed to structural measures are summarized as follows:

Forest land	Pastureland	Total
----- (acres) <u>1/</u> -----		

Site 20

Sediment Pool	93	0	93
Flood Pool	290	25	315
Dam & Emergency Spillway	4	1	5
Borrow Areas	4	4	8

Site 21

Sediment Pool	60	0	60
Flood Pool	166	29	195
Dam & Emergency Spillway	5	1	6
Borrow Areas	5	0	5

Site 32

Sediment Pool	218	0	218
Recreation Pool	402	0	402
M&I Pool	537	3	540
Flood Pool	947	47	994
Dam & Chute Spillway	16	0	16
Borrow Areas	11	0	11
Recreation <u>2/</u>	1,087	67	1,154

1/ Pool areas are cumulative.

2/ Includes recreational areas, normal pool, dam and spillway, borrow areas, and part of the flood pool.

During construction, the following actions will be taken to control erosion and pollution:

- a. Sprinkling will be used to keep dust in construction areas within acceptable limits.
- b. Sanitary facilities will be installed according to the requirements of the South Carolina Department of Health and Environmental Control.
- c. Measures will be provided at equipment and repair areas to prevent contaminants from reaching streams and ground water.
- d. All operations will be conducted to minimize stream turbidity at and below the structures. Requirements established by the South Carolina Department of Health and Environmental Control will be conformed to during construction. The following erosion and sediment control measures will be applied as needed to the area of land which will be exposed:
 - (1) the contract will include earthmoving equipment time to construct diversions, waterways, and terraces as needed to retard the rate of runoff and control runoff from the construction site;
 - (2) debris basins will be used to minimize sediment leaving the construction site where needed;
 - (3) clearing and grubbing of construction sites and borrow areas will occur in stages as construction progresses;
 - (4) temporary vegetation and/or mulching will be used to protect the soils; segments of work will be completed and protected as rapidly as is consistent with construction schedules; and
 - (5) conduits or bridges will be installed where construction activities cross flowing streams.
- e. Prior to construction, areas will be designated for the disposal of waste material. All debris will be disposed of in accordance with regulations of the South Carolina Department of Health and Environmental Control. The landowners of the area to be cleared will be given the opportunity to salvage trees prior to the beginning of construction.

- f. Vector control will be mutually agreed upon by the Soil Conservation Service, local sponsors, and the South Carolina Department of Health and Environmental Control.

Included in changes to fixed improvements needed to install the project measures, is the raising and lengthening of the bridge over South Rabon Creek on State Secondary Highway 312 located within the flood pool of Site 32. The bridge will be raised five feet to elevation 544.5 and will be lengthened by 30 feet. The 16 inch raw water line from the pump station passes through the area where the chute spillway will be located. It will be relocated and will cross through the entrance channel leading to the chute spillway.

Two bridges over South Rabon Creek and within the flood pool of Site 20 will be raised and lengthened. The bridge on State Secondary Highway 451 will be raised four feet to elevation 719.5 and will be lengthened 15 feet. The bridge over the first county road upstream from Structure 20 will be raised 12 feet to elevation 719.5 and lengthened 30 feet. A co-op power pole located in the flood plain of South Rabon Creek upstream from the latter described bridge will be moved to a higher elevation. The top of dam elevation of a farm pond located near this same bridge is approximately the same elevation as the crest of the emergency spillway of the structure. Since the emergency spillway of the structure is set at the 100-year flood frequency level, no changes to the farm pond are planned.

The 70 foot steel truss bridge over North Rabon Creek on State Secondary Highway 259, within the flood pool of Site 21, is 3.8 feet lower than the emergency spillway level. Instead of raising the old bridge, a new 150 foot reinforced concrete bridge will be installed at elevation 689.0, 5.3 feet higher than the old bridge. Another bridge, (wooden) located at the next crossing upstream from the steel bridge is also lower than the emergency spillway level. It will not be replaced since it is 18.5 feet above the normal pool level and will not be frequently inundated. Adequate access is available to the area by other roads. Two, old, abandoned houses and an old barn are below the top of dam elevation in Site 21. One house and the barn are used for storing hay, but are above the maximum water surface elevation during the passage of the emergency spillway storm and will not be moved. The other abandoned house is near the emergency spillway elevation, has little value and will not be moved. The old Owings Family Cemetery is located downstream from the centerline of Structure 21 on the right abutment. This area will not be disturbed during construction. One telephone pole near the old steel bridge on State Secondary Highway 259 will be raised.

The project will comply with the Historic and Archeological Data Preservation Act, Public Law 86-523 and the Historic Properties Preservation Program, Public Law 89-665 (Section 106). The watershed work plan has been coordinated with the Institute of Archeology and Anthropology, University of South Carolina. Field investigations by the

Institute indicate that the project will not encroach on any archeological values. One building in the watershed is listed in the National Register of Historic Places, but it is not affected by the project. If artifacts or other items of archeological or historical significance are uncovered during construction, the Institute of Archeology and Anthropology and the National Park Service will be notified.

EXPLANATION OF INSTALLATION COSTS

Land treatment measures to be applied during the project installation period are estimated to cost \$754,300. (See Table 1.) Of this total, \$189,600 will be paid by PL-566 funds and \$564,700 will be provided from other funds.

To meet the goals of adequate land treatment, PL-566 funds will provide \$68,800 for technical assistance by the Soil Conservation Service and \$76,200 by the U.S. Forest Service. In addition, PL-566 funds will provide \$37,000 for cost sharing for critical area stabilization by the Soil Conservation Service and \$7,600 for tree planting on critical areas by the U.S. Forest Service.

Other funds include \$38,300 for technical assistance provided under the going program of the Soil Conservation Service, \$20,900 from the various forestry programs, and \$1,000 from the South Carolina Wildlife and Marine Resources Department.

The remainder of other funds will be borne by individual landowners and operators utilizing the cost sharing assistance, if available, through the Rural Environmental Assistance Program. These costs include materials, labor, and machinery necessary for the installation of land treatment measures.

Total structural installation cost is \$2,726,800 and consists of construction, engineering services, project administration, and land rights. (See Table 2.)

The construction cost of each structural measure is the estimated cost of all material and labor necessary for construction. These costs, estimated to be \$1,950,700, were determined for each structure by estimating the quantities required for construction and applying unit costs based on previously constructed projects. Included in the construction cost is a 12 or 15 percent contingency allowance to cover unforeseen items that may be encountered during construction.

Engineering services are estimated to be \$102,300 and consist of the cost of design surveys, geological investigations, design, and preparation of plans and specifications for the structural measures.

Project administration costs, estimated to be \$81,400, consist of costs associated with the installation of structural measures, including the cost of contract administration, review of engineering plans prepared by others, government representatives, construction surveys, and necessary inspection during construction.

Land rights costs include land easement values and expenditures made in acquiring easements and rights-of-way, and all costs associated with altering roads and bridges, power lines, telephone lines, and a raw water pipeline. These costs are estimated to total \$592,400.

No relocation costs are anticipated for project installation.

The total installation costs, except administration, of Structures 20 and 21 were allocated to flood prevention. (See Table 2A.) Costs of Structure 32, except administration, were allocated by the Use of Facilities Method. Project administration costs were not allocated as they were not considered applicable to the individual purposes served.

Costs will be shared by PL-566 funds and other funds as follows:

1. Construction costs allocated to flood prevention will be paid by PL-566 funds. Construction costs allocated to recreation will be shared equally between PL-566 and other funds. Construction costs allocated to municipal water will be paid by other funds.
2. Engineering costs allocated to flood prevention will be paid by PL-566 funds. Engineering costs allocated to municipal water will be paid by other funds. Engineering costs associated with Structure 32 which are allocated to recreation will be paid by PL-566 funds. Engineering costs associated with the recreational development will be shared equally by PL-566 and other funds.
3. Land rights and appraisal costs allocated to flood prevention and municipal water will be paid by other funds. Land rights and appraisal costs allocated to recreation will be shared equally by PL-566 and other funds. All legal fees and serving costs will be paid by other funds.
4. Relocation costs, if any are incurred, will be shared by PL-566 and other funds 58.1 percent and 41.9 percent, respectively. Relocation assistance advisory services and relocation assistance will be paid by other funds.
5. The Service and sponsors will each bear the costs of project administration which it incurs.

Total structural measures costs amount to \$2,726,800. These are to be shared by PL-566 funds and other funds \$1,834,000 and \$892,800 respectively.

Estimated expenditures by years are as follows:

Project Year	PL-566 Funds		Other Funds	
	Structural Measures	Land Treatment	Structural Measures	Land Treatment
First	\$ 24,000	\$ 46,000	\$ 157,600	\$107,200
Second	420,250	46,000	240,450	121,000
Third	274,400	43,600	12,300	120,000
Fourth	1,000,850	30,000	375,950	114,700
Fifth	114,500	24,000	106,500	101,800
TOTAL	\$1,834,000	\$189,600	\$ 892,800	\$564,700

EFFECTS OF WORKS OF IMPROVEMENT

Flood Prevention, Erosion and Sediment

Rates of erosion on uplands will be reduced by the installation of land treatment practices and the stabilization of critically eroding areas. Land treatment measures will reduce floodwater damages by about three percent. Treatment of 465 acres of critically eroding areas will result in a substantial reduction in sediment. Gross erosion rates will be reduced by types as follows: sheet erosion on cropland and pastures, 20 percent; erosion of roadbanks and dirt roads, 50 percent; and gully erosion, 50 percent. Less sediment being deposited in lakes and on flood plain land will result in improved fish and wildlife habitat and greater yields from agricultural land. As sediment is reduced, there will be a reduction of chemical and other pollutants being transported downstream.

The project measures will reduce floodwater damages on 3,020 acres of flood plain land by an average of 76 percent. For the reaches downstream from Site 20 to the backwater of Structure 32, the area flooded by a storm expected to occur on the average of once in three years will be reduced from 432 acres without the project to 34 acres with the project. For the reaches downstream from Site 21, the acres flooded by the three year storm will be reduced from 323 to 58 acres. For the reaches downstream from Site 32, the area flooded by the three year storm will be reduced from 1,443 to 872 acres.

All of the area for about a quarter of a mile below Site 20 will be protected from storms up to the 100 year frequency. From there to State Highway 101, there will be no flooding by the three year storm and little flooding by the 10 year storm. For the reach downstream from State Highway 101 to the backwater of Structure 32, most of the area will be protected from the two year frequency storm. This area can be used for row crops or improved pastures.

For the reach downstream from Site 21 to State Highway 101, almost all of the flood plain land will be protected from the three year frequency storm. The reach from this point to the backwater of Site 32 will be protected from the one year frequency storm.

On Rabon Creek downstream from Site 32, to the backwaters of Lake Greenwood, the flood plain will have protection from flooding suitable for improved pastures. This land should not be used for row crops because of the remaining flood hazard.

Future flood plain land use without and with the project is estimated as follows:

	<u>Without Project</u> (acres)	<u>With Project</u> (acres)
Crops	200	400
Pastures	2,000	2,500
Forests	3,700	2,800
Other	500	700

Major crops to be grown in the flood plain are expected to be soybeans, corn, and silage, along with a few acres of truck crops. Pastures will be primarily fescue and clover. Forests will be primarily bottom land hardwoods. It is estimated that the project will result in 700 acres of bottom land hardwood being converted to crops and pasture. As a result of the reduced flood hazard, the land which will be devoted to crops and pasture will be used more intensively. Improved varieties of seed and better farming techniques will be used. At least 85 farms will be affected by the works of improvement. Net income of farmers will be improved through harvest of higher crop yields and improved quality brought about by more timely planting and harvesting of crops.

Sediment deposition and swamping on the flood plain, affecting about 750 acres, will be reduced 65 percent. Through the reduction of flooding and sediment, most of this land can recover to its former productivity with the addition of fertilizer, lime and the application of good management practices. Sediment yield to Lake Greenwood will be reduced from an average of 58 acre feet per year to 14 acre feet per year, a 76 percent reduction. The estimated average annual sediment concentration will be reduced at a point about one mile from the watershed outlet from 630 mg/l to an average of 160 mg/l. This reduction in suspended sediment will result in improved fish habitat in the backwaters of Lake Greenwood. The aesthetic quality of the backwaters will be enhanced and the reduction in sediment load will increase the life of Lake Greenwood. The cost of treating municipal and industrial water will be reduced. Floodwater damages to roads and bridges will be reduced by about 65 percent.

The value of land adjoining the permanent pools will be enhanced. It is estimated that within 5-10 years after the structures are built, 120 homesites will be developed adjacent to or near the pools. Soil

surveys indicate that soils in this area are suitable for home sites. Health authorities in the counties maintain control of the type of sewage disposal facilities required to prevent water contamination. Land use regulations as to type of development for the preservation of land and protection of wildlife habitat will be enforced.

Water Supply

The water stored in Site 32 to supply Laurens County and a small portion of Greenville County will serve an estimated 76,000 people by the year 2000. The water, with an estimated sustained yield of 20 million gallons per day, will be used by residences, businesses, and industries already located in the area as well as those expected to move into the area. The supply of water will help the area take advantage of industrial development opportunities. Additional jobs will be created by expanding industries, newly located industries and expanded businesses.

The quality of water to be stored in Site 32 meets standards set by the South Carolina Department of Health and Environmental Control for domestic and industrial use, with proper treatment.

Fish and Wildlife and Recreation

Forest wildlife habitat will be changed to grassland or cropland type habitat by the clearing of 700 acres of land that will be restored to its former productivity. Stocking of the 693 acres of water in the three structures will provide excellent habitat for bluegill, shellcracker, crappie, largemouth bass, and channel catfish.

The long, and relatively narrow, lakes created by the structures will provide an escape for deer from free-running dogs. Deer readily swim across such bodies of water and thereby lose dogs from their trail.

Upland wildlife habitat will be enhanced by the development and management of 300 acres of wildlife food and cover, other land treatment measures and treatment of critically eroding areas. The quality of water will be improved as vegetation prevents erosion from the watershed.

The edges of the lakes will provide about 40 miles of shoreline habitat favorable for herons, egrets, and shorebirds, which are now absent from the watershed or are in low numbers. A muskrat population can be expected to develop which will contribute to future fur resources.

The temporary floodwater storage area of the structures will not have a significant effect upon motile wildlife species. The water will rise slowly enough for all such species to move out of the flood pool area and they will only be denied use of it during the few days needed for the water to recede to normal levels. Most wildlife food and cover plants can survive the temporary inundation. Nests of ground nesting birds and mammals will be destroyed if the flooding should occur during their nesting season. However, as with nests lost to all natural causes, renesting usually takes place quickly.

Water temperature within the structures will be increased due to the increased water surface exposure. This will result in a maximum temperature increase of five degrees downstream from the structures. Evaporation losses will also be greater due to the exposed water surface.

When water is released from the reservoir bottom for low flow augmentation, there will be a noticeable increase of ammonia and carbon dioxide, and a shortage of dissolved oxygen in this water for about 200 yards downstream from the structures. Fish will be forced out of this reach on the rare occasions when water is released.

Water stored in Structure 32 and the two recreational areas will provide an estimated 49,000 visitor days of recreation each year. The major activities will be fishing and picnicking. Other activities will include boating, sight-seeing, hiking, and similar activities. Boat ramps, sanitary facilities, parking lots, and other facilities will be installed. The area will be open to the general public.

Effects associated with the increase in recreational opportunities include additional waste for disposal and increased travel in the area.

Some incidental recreational opportunities could be available at Sites 20 and 21. Before these sites can be used by the public or organized groups, sanitary facilities must be provided. During periods of prolonged drouths, water impounded in the structures could be used to irrigate crops or pastures or augment streamflow.

Archeological Historic, and Scientific

The only building in the watershed that is listed in the National Register of Historic Places is the Sullivan House located near Hickory Tavern, but it will not be affected by the project. If any artifacts or other items of archeological or historical significance are uncovered during construction, the Institute of Archeology and Anthropology and the National Park Service will be notified.

Economic and Social

Employment opportunities will be increased as a result of the project. Unemployed and underemployed persons will have more opportunities to find jobs or to be more fully employed. Underemployed farmers will be able to better utilize flood plain land for more efficient farming operations. An ample supply of municipal and industrial water will encourage present industries and businesses to expand their operations and will encourage other industries to locate in the community. It is estimated that 110 permanent jobs will result from the project. In addition, 50 man-years of employment will be created by the installation of the project.

The construction of new homes and industries, the increase of business activity, and the increase of travel in the watershed will increase the burden of waste disposal and adverse effects associated with greater population and increased travel.

Local secondary benefits in the form of increased business from transporting additional supplies and products and other business activity will accrue to residents of the community.

Enhanced land values, new homes, new and expanded industries, and more business activity will tend to improve the tax base thereby providing more funds for education and other social functions in the community.

Other

A total of 1,555 acres of land will be used for pool areas, dams, and borrow areas in project installation. This total will be used as follows: sediment storage, 371 acres; recreation and municipal and industrial water supply storage, 322 acres; floodwater storage, 811 acres; dams and spillways, 27 acres; and borrow areas above flood pools, 24 acres. An additional 361 acres will be used for recreational areas. The agricultural values will be lost and wildlife values reduced due to the heavy influx of man into this area. The areas committed to sediment, recreation, municipal and industrial water supply storage will be permanently inundated. Existing agricultural values will be lost and wildlife values altered on these areas. The area used for floodwater storage will be inundated periodically but can be used for pasture, forests or wildlife. The dams and spillways are lost to crops or forests but will be established in grass. The borrow areas will be revegetated with grasses, trees, or wildlife plantings. Recreational areas will be managed as natural areas with only the necessary alterations required to install the planned recreational facilities. Land use in the areas inundated is three acres of pasture and 690 acres of forest. Land use in the area that will be occasionally inundated is 98 acres of pasture and 713 acres of forest.

The three structures will inundate 10.2 miles of stream channels. These channels are in the portions of Rabon Creek identified as not being used by fishermen but are in areas that provide sources of food for fish and wildlife. The structures could interfere with migration of small fish.

The total area to be cleared for the project is 827 acres, consisting of 776 acres in and adjacent to structure sediment and normal pool areas and 51 acres in structure embankments, spillways, and borrow areas. About 60 percent of this clearing, or 490 acres, will be on flood plain lands. This represents a loss of about 11 percent of similar bottom land wildlife habitat in the watershed. About 25 acres of the flood plain clearing for Structure 32 will be in two of the wildlife management areas.

PROJECT BENEFITS

Damage reduction benefits to crops and pastures amounts to \$14,500 annually. This benefit includes \$5,800 for restoration to former productivity. Other agricultural damage reduction benefits in the form of reduced flood damage to farm roads, equipment, fences, and livestock losses amount to \$3,300 annually. Nonagricultural floodwater damage reduction benefits total \$3,500 per year and are primarily from reduced floodwater damages to roads and bridges. Total floodwater damage reduction benefits are \$21,300. Annual sediment reduction benefits total \$3,500 from reduction of overbank deposition, \$200 from a reduction in swamping and \$35,200 from the reduction of sediment to Lake Greenwood. Flood plain scour damage reduction benefits are \$200. Indirect flood

damage reduction benefits are expected to be \$9,900 annually (Table 5).

More intensive land use benefits will be \$31,000 annually. Benefits from municipal water storage are estimated to be \$60,500 annually. Recreation benefits amount to \$85,800 annually. Incidental land enhancement benefits will amount to \$5,600 annually.

The value of local secondary benefits that will accrue in the watershed and surrounding area due to project installation amount to \$39,300. The value of secondary benefits from a national viewpoint was not considered in the economic evaluation or justification of this project.

Redevelopment benefits are estimated to average \$27,400 per year during the life of the project.

The land treatment practices to be installed will result in benefits such as reduced erosion, lower sediment yields, greater productivity of the soil, and beautification of the countryside. Forest land treatment measures and fire protection will improve the hydrologic condition and productivity of the forest land. Both small game and fisheries resources will be improved by the project measures including structural measures, land treatment and emphasis given wildlife treatments during silvicultural prescriptions and other management advice.

COMPARISON OF BENEFITS AND COSTS

The average annual cost of structural measures, including project installation, project administration, and operation and maintenance, is estimated to be \$170,300. These measures are expected to produce average annual benefits of \$316,800. The ratio of average annual benefits to average annual costs is 1.9 to 1. The ratio of benefits to costs without local secondary benefits is 1.6 to 1. A comparison of benefits to costs is shown in Table 6.

PROJECT INSTALLATION

Land treatment measures will be established by landowners and operators through cooperative agreements with the Laurens and Greenville County Soil and Water Conservation Districts. The Soil Conservation Service and the South Carolina State Commission of Forestry will assist landowners and operators in planning and applying land treatment measures consistent with the authorities and capabilities of each agency. Technical assistance will be accelerated to assure application of the land treatment measures within the five year installation period. When landowners or operators desire assistance from some other agency or private consultant, they will be referred to the appropriate agency or consultant.

The soil and water conservation districts will be responsible for installing critical area stabilization measures. The South Carolina State

Commission of Forestry and the Soil Conservation Service will provide technical assistance for this work. Critical areas will be stabilized by a division of work between the soil and water conservation districts and the Soil Conservation Service. The districts will acquire agreements with individual owners and the highway departments in each county.

The 90 acres of critical areas to be treated by planting trees will be a division of work as follows: The districts will furnish trees and mulch and construct fences. The Service will provide funds through the South Carolina State Commission of Forestry for building brush dams and planting trees.

The division of work for stabilizing 333 acres of critically eroding fields will be as follows: The districts will prepare seedbeds and establish vegetation. The Service will furnish materials.

Eighteen gullies will be treated as follows: The districts will cut trees, construct diversions, prepare seedbeds, and establish vegetation. The Service will construct grade control structures, debris basins, pipe or drop structures, and provide materials.

The division of work for stabilizing roadbanks will be as follows: The districts will prepare sites by sloping the roadbanks and preparing the seedbeds. The Service will furnish materials and establish suitable vegetation. The work which the Service is to perform does not exceed cost-sharing rates for such practices applicable under other going programs.

Prior to the Service providing financial assistance for the construction of any planned structural measure, the following conditions must be met:

(1) The Greenville County and Laurens Soil and Water Conservation Districts must obtain agreements with landowners to carry out soil and water conservation plans on at least 50 percent of the area above each structure, (2) adequate land treatment measures must be applied on at least 75 percent of those sediment source areas which, if uncontrolled, would materially increase the cost of construction, operation, or maintenance of the structural measures, (3) land rights must be obtained for all structural measures within a construction unit (Table 7), (4) specific operation and maintenance agreements must be executed, and (5) the Sponsoring Local Organizations must be prepared to discharge their responsibilities.

The Sponsoring Local Organizations have requested that the Soil Conservation Service do the contracting for the three structures and the Service has agreed to do the contracting. The Rabon Creek Watershed Conservation District will be responsible for dealing with the Soil Conservation Service during construction of Structures 20 and 21. The Laurens County Water Resources Commission will be responsible for dealing with the Service during construction of Structure 32.

The Rabon Creek Watershed Conservation District will be responsible for acquiring all land rights for the structural measures. The district has sufficient legal authority (including the power of eminent domain) and funds and agrees to use such authority and funds, if necessary, to acquire land rights needed for the project. The Laurens County Water Resources Commission agrees to assist the district in acquiring land rights for Structure 32.

Prior to purchase of any land or land right the local sponsoring organizations will be responsible for having an appraisal made by a qualified land appraiser.

Engineering services for Structures 20 and 21 will be performed by the Service. Engineering services for Structure 32 will be obtained through a negotiated contract with a private engineering firm agreed to by the Laurens County Water Resources Commission and the Service.

Planned installation of structural measures over the five year installation period is as follows:

First year - secure land rights for Structures 20 and 21,
investigate site and design Structure 20;

Second year - secure land rights for Structure 32,
investigate site and design Structure 21, and
construct Structure 20;

Third year - investigate site and design Structure 32 and
construct Structure 21;

Fourth year - construct Structure 32, and design recreational
facilities; and

Fifth year - install recreational facilities

The schedule of these planned installation measures may change as deemed necessary, except that construction of Structure 32 must be after or concurrently with Structures 20 and 21.

Prior to construction of the project the National Park Service, the State Archeologist and the State Liaison Officer for Historic Preservation will be notified so that they can provide the necessary protection or salvage of any items of archeological or historic value.

FINANCING PROJECT INSTALLATION

The cost of installing land treatment measures, which are normally included in conservation plans, will be borne by individual landowners or operators. The portion of the division of work to be furnished by other than PL-566 funds, for critical area stabilization on privately owned land, will be furnished by individual landowners or operators providing equipment, labor, or materials. For roadside treatment, the division of work to be paid by other than PL-566 funds will be provided by the state or county highway departments in each of the counties by furnishing equipment and labor.

The Laurens County Water Resources Commission has the financial support of Laurens County through annual appropriations to pay organizational

and planning expenses. The Public Works Commission of the city of Laurens is deeply involved in the installation of Structure 32 for its water supply and has expressed a willingness to financially support the Laurens County Water Resources Commission in the installation of that structure.

Negotiations are underway between the Laurens County Water Resources Commission and the State Director of the Farmers Home Administration, including the filing of a preliminary application, for a loan to pay the non-federal share of Structure 32 and the recreational facilities. Funds are needed for purchasing approximately 1,154 acres of land, paying a share of the engineering services contract, and paying a share of the construction costs. The estimated amount of the loan needed is \$700,000. Funds for repayment of the loan will be obtained from the sale of water from Structure 32, user fees, and an annual appropriation from Laurens County.

Based on a survey of owners of land where Structures 20 and 21 will be constructed, the sponsors expect all land rights for these two structures to be donated. The Sponsoring Local Organizations will purchase about 1,154 acres at Site 32. This area includes 540 acres for the municipal and industrial water supply pool and 615 acres for the dam and spillways, borrow areas, a portion of the flood pool, and areas designated for recreation. Other areas (426 acres), which will be occasionally inundated will be obtained by easements. The sponsors expect these easements to be donated. The cost of land rights will be paid by funds borrowed from the Farmers Home Administration.

Where land rights are purchased, the regulations of the Uniform Relocation Assistance and Real Property Acquisition Act of 1970 (Public Law 91-646, 84 Stat. 1894) will be followed.

The county road departments and the state highway department will make needed road and bridge alterations that are necessary for structural measure installations.

The installation costs of recreational facilities will be paid by funds appropriated by Laurens County for this special purpose.

Federal assistance for carrying out the works of improvement described in this work plan will be provided under the authority of the Watershed Protection and Flood Prevention Act (PL-566), as amended. Financial and other assistance to be furnished by the Service in carrying out the plan is contingent upon the availability of funds for this purpose.

OPERATION AND MAINTENANCE

The Laurens and Greenville County Soil and Water Conservation Districts will be responsible for maintenance of the sites where critical area treatment practices will be applied. Landowners and operators will maintain land treatment measures located on their land through cooperative agreements with the soil and water conservation districts. The Service and the State Commission of Forestry will provide technical assistance for maintenance.

Structures 20 and 21 will be operated and maintained by the Rabon Creek Watershed Conservation District through funds obtained from a tax levy on real property in the watershed. The estimated annual operation and maintenance cost of these structures is \$600.

Structure 32 will be operated and maintained by the Rabon Creek Watershed Conservation District. Maintenance of this structure, estimated to be \$1,000 annually, will be financed through the sale of water.

Maintenance of structures will include, but is not limited to, mowing, fertilizing and controlling the vegetation; repair of any damage to the principal spillways, emergency spillways, the chute spillway, and embankments; and removal of any floating logs and debris which may affect the operation of the structures.

The Rabon Creek Watershed Conservation District will operate and maintain the recreational development associated with Site 32. A full-time employee will be hired to operate and maintain recreational facilities. During peak use periods additional help will be procured. The recreational areas will require repair and replacement of facilities, mowing of grassed areas, and other normal upkeep. Annual operation and maintenance of facilities is estimated to be \$14,700. Funds to defray these costs will come from an annual appropriation by Laurens County and from user fees.

The 693 surface acres of water impounded by the three structures will be stocked with game fish and managed according to recommendations by the South Carolina Wildlife and Marine Resources Department.

Specific maintenance agreements between the Service and the sponsors will be executed prior to issuing bid invitations for construction of each measure. The operation and maintenance of structural measures will be performed as indicated in the South Carolina Watershed Operations and Maintenance Handbook, prepared by the Soil Conservation Service.

The South Carolina Department of Health and Environmental Control will monitor water quality at Site 32 to make sure that the state water quality standards are met.

During periods of low stream flow, water will be released through gates installed on the principal spillway risers for reservoir management. Released rates will at least equal inflow to the reservoir to provide for downstream use and to maintain a beneficial equilibrium of biological organisms. The Rabon Creek Watershed Conservation District will be responsible for releasing water as needed.

For three years following installation of the structural measures, the Service and the sponsors will make joint inspections annually, after unusually severe floods, or after the occurrence of any other unusual event that might affect the structural measures. Inspection after the third year will be made by the sponsors. One copy of their annual report will be sent to the Service representative and one copy filed by the sponsors and made available for authorized inspection.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST

Rabon Creek Watershed, South Carolina

Installation Cost Item	Unit	Number	Estimated Cost (Dollars) 1/				Total
			PL-566 Funds		Other		
			SCS 2/	FS 2/	SCS 2/	FS 2/	Total
LAND TREATMENT							
Land Areas 3/							
Cropland	Ac.	2,400	-	-	91,600	-	91,600
Pastureland	Ac.	3,300	-	-	198,000	-	198,000
Forest land	Ac.	12,900	-	-	-	141,500	141,500
Other land	Ac.	500	-	-	35,000	-	35,000
Individual Practices							
Fire Control	Ac.	53,741	-	-	-	10,700	10,700
Critical Area Stabilization							
Tree Planting	Ac.	90	-	7,600	7,600	-	1,700
Roadside Stabilization	Ac.	15	3,000	-	3,000	-	3,000
Gullies	Ac.	27	16,000	-	16,000	5,000	5,000
Fields	Ac.	333	18,000	-	18,000	-	18,000
Technical Assistance			68,800	76,200	145,000	38,300	21,900 4/
TOTAL LAND TREATMENT	xxx		105,800	83,800	189,600	388,900	175,800
STRUCTURAL MEASURES							
Construction							
Floodwater Retarding Strs.	No.	2	431,400	-	431,400	-	-
Multiple Purpose Str.	No.	1	960,700	-	960,700	350,000	350,000
Recreational Facilities			104,300	-	104,300	104,300	104,300
Subtotal-Construction			1,496,400	-	1,496,400	454,300	-
Engineering Services			87,000	-	87,000	15,300	-
Project Administration							
Construction Inspection			27,000	-	27,000	4,000	-
Other			43,200	-	43,200	7,200	-
Subtotal-Administration			70,200	-	70,200	11,200	-
Land Rights			180,400	-	180,400	412,000	-
TOTAL STRUCTURAL MEASURES			1,834,000	-	1,834,000	892,800	-
TOTAL PROJECT			1,939,800	83,800	2,023,600	1,281,700	175,800
							1,457,500
							3,481,100

1/ Price base - 1973.

2/ Federal agency responsible for assisting in installation of works of improvement.

3/ Includes only areas estimated to be adequately treated during the project installation period. Treatment will be accelerated throughout the watershed, and dollar amounts apply to total land areas, not just to adequately treated areas.

4/ Includes \$7,000 from the going Cooperative Forest Management Program and \$1,000 from the South Carolina Wildlife and Marine Resources Department.

April 1974

TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT
(at time of Work Plan preparation)

Rabon Creek Watershed, South Carolina

Measures	Unit	Applied to Date	Total Cost (Dollars) 1/
<u>LAND TREATMENT</u>			
Cooperative Forest Fire Control	Ac.	53,741	70,000
Conservation Cropping Systems	Ac.	5,506	5,500
Contour Farming	Ac.	3,651	1,800
Critical Area Planting	Ac.	620	49,600
Diversions	Ft.	10,000	3,000
Drainage Field Ditch	Ft.	20,000	4,000
Drainage Main or Lateral	Ft.	10,000	4,000
Field Border	Ft.	85,000	8,500
Grassed Waterway or Outlet	Ac.	135	6,800
Pasture & Hayland Management	Ac.	3,200	64,000
Pasture & Hayland Planting	Ac.	6,431	257,200
Pond	No.	100	100,000
Forest Land Release	Ac.	200	4,000
Terrace, Gradient	Ft.	670,000	20,100
Terrace, Parallel	Ft.	50,000	2,500
Tree Planting	Ac.	6,294	12,600
Wildlife Habitat Management	Ac.	300	1,500
Land Adequately Treated	Ac.	37,500	-
 TOTAL	 xxx	 xxx	 615,100

1/ Price base - 1973.

April 1974

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Rabon Creek Watershed, South Carolina

Item	(Dollars) 1/							
	Installation Cost - PL 566 Funds				Installation Cost - Other Funds			
	Con- struction	Engi- neering	Land Rights	Total P.L. 566	Con- struction	Engi- neering	Land Rights	Total Installation Cost
<u>Multiple Purpose</u>								
Structure 32								
Joint Costs	960,700	55,000	120,400 2/	1,136,100	266,300	9,000	194,800 3/	470,100
Specific Costs	-	-	-	-	83,700 4/	300	-	84,000
Recreational Facilities	104,300	6,000	60,000 5/	170,300	104,300	6,000	61,600 6/	171,900
Subtotal	1,065,000	61,000	180,400	1,306,400	454,300	15,300	256,400	726,000
<u>Floodwater Retarding</u>								
Structure 20	232,000	14,000	-	246,000	-	-	83,000 7/	329,000
Structure 21	199,400	12,000	-	211,400	-	-	72,600 8/	284,000
Subtotal	431,400	26,000	-	457,400	-	-	155,600	613,000
Subtotal	1,496,400	87,000	180,400	1,763,800	454,300	15,300	412,000	881,600
<u>Project</u>								
Administration				70,200				81,400
GRAND TOTAL	1,496,400	87,000	180,400	1,834,000	454,300	15,300	412,000	892,800
1/ Price base - 1973.								
2/ Includes \$8,450 for road and bridge changes and \$5,700 for relocating water line.								
3/ Includes \$10,750 for road and bridge changes, \$5,500 for legal fees, \$21,300 for flowage easements, and \$7,200 for relocating water line.								
4/ Includes \$81,000 for grubbing the pool area and \$2,700 for municipal water outlet, gates and riser.								
5/ Includes \$200 for land appraisals.								
6/ Includes \$1,500 for legal fees and \$200 for land appraisals.								
7/ Includes \$480 for power line changes and \$28,200 for road and bridge changes.								
8/ Includes \$480 for telephone line changes and \$38,400 for road and bridge changes.								

April 1974

TABLE 2A - COST ALLOCATION AND COST SHARING SUMMARY

Rabon Creek Watershed, South Carolina

(Dollars) 1/

Item	COST ALLOCATION				COST SHARING					
	PURPOSE				PL-566			OTHER		
	Flood Prevention	Recreation	M&I Water	Total	Flood Prevention	Recreation	Total	Flood Prevention	Recreation	M&I Water Total
Multiple Purpose Structure 32	933,100	442,700	230,400	1,606,200	911,300	224,800	1,136,100	21,300	218,400	230,400
Joint Costs	-	-	84,000	84,000	-	-	-	-	-	84,000
Specific Costs	-	342,200	-	342,200	-	170,300	170,300	-	171,900	-
Recreational Facilities	-	784,900	314,400	2,032,400	911,300	395,100	1,306,400	21,300	390,300	314,400
Subtotal	933,100	784,900	314,400	2,032,400	911,300	395,100	1,306,400	21,300	390,300	726,000
Floodwater Retarding	329,000	-	-	329,000	246,000	-	246,000	83,000	-	-
Structure 20	284,000	-	-	284,000	211,400	-	211,400	72,600	-	-
Structure 21	613,000	-	-	613,000	457,400	-	457,400	155,600	-	-
Subtotal	1,546,100	784,900	314,400	2,645,400	1,368,700	395,100	1,763,800	176,900	390,300	314,400
GRAND TOTAL	1,546,100	784,900	314,400	2,645,400	1,368,700	395,100	1,763,800	176,900	390,300	881,600

1/ Price base - 1973.

April 1974

TABLE 2B - RECREATIONAL FACILITIES
ESTIMATED CONSTRUCTION COSTS

Rabon Creek Watershed, South Carolina

(Dollars) 1/

Item	Number	Unit Cost	Total Construction Cost
<u>North Rabon Creek Access Area</u>			
1. Roads, paved	0.5 Miles	50,000	25,000
2. Parking Areas, paved			
a. Boats & Trailers	25 Spaces	380	9,500
b. Cars	25 Spaces	176	4,400
3. Boat Ramp, 12'x80'	1	5,400	5,400
4. Bridge, Reinforced Concrete	1	6,800	6,800
5. Foot Trail, unpaved	1.0 Miles	3,000	3,000
6. Picnic Tables, concrete & wood	25	130	3,250
7. Cast Iron Grills	15	80	1,200
8. Underground Waste Receptacle Units	15	50	750
9. Picnic Shelter, 20'x40'	1	3,500	3,500
10. Comfort Station			
a. 4 Unit, 2+2	1	10,000	10,000
b. 2 Unit, 1+1	1	6,600	6,600
11. Water Supply & Waste Disposal System	1	5,100	5,100
12. Electrical Distribution System	1	1,500	1,500
13. Seeding & Landscaping	1	2,000	2,000
14. Signs & Gates	1	600	600

TABLE 2B - RECREATIONAL FACILITIES
ESTIMATED CONSTRUCTION COSTS

Rabon Creek Watershed, South Carolina

(Dollars) 1/

Item	Number	Unit Cost	Total Construction Cost
<u>South Rabon Creek Access Area</u>			
1. Roads, paved	0.4 Miles	50,000	20,000
2. Parking Areas, paved			
a. Boats & Trailers	50 Spaces	380	19,000
b. Cars	30 Spaces	176	5,280
3. Boat Ramp, 24'x80'	1	9,600	9,600
4. Foot Trail, unpaved	0.5 Miles	3,000	3,000
5. Picnic Tables, concrete & wood	40	130	5,200
6. Cast Iron Grills	25	80	2,000
7. Underground Waste Receptacle Units	25	50	1,250
8. Picnic Shelter, 20'x40'	2	3,500	7,000
9. Comfort Station			
a. 4 Unit, 2+2	1	10,000	10,000
b. 2 Unit, 1+1	1	5,100	5,100
10. Water Supply & Waste Disposal System	1	5,100	5,100
11. Electrical Distribution System	1	1,470	1,470
12. Seeding & Landscaping	1	3,000	3,000
13. Signs & Gates	1	600	600
Subtotal			186,200
Contingencies			22,400
TOTAL ESTIMATED CONSTRUCTION COSTS			208,600

1/ Price base - 1973

TABLE 3 - STRUCTURAL DATA
STRUCTURES WITH PLANNED STORAGE CAPACITY

Rabon Creek Watershed, South Carolina

Item	Unit	Structure Number			Total
		20	21	32	
Class of Structure					
Drainage Area	Sq. Mi.	b	b	b	92.99
Controlled	Sq. Mi.	16.82	13.72	92.99	
Curve No. (1-day) (AMC II)		-	-	30.54	
Elevation Top of Dam		70	70	73	
Elev. Crest Emergency Spillway	Ft.	724.5	696.0	551.5	
Elev. Crest Principal Spillway Inlet	Ft.	718.0	687.5	1/	
Elev. Top of Recreation Pool	Ft.	700.5	664.5	529.5	
Maximum Height of Dam	Ft.	-	-	524.0	
Volume of Fill	Cu. Yds.	45	50	57	
Total Capacity		106,000	91,400	297,000	494,400
Sediment Submerged	Ac. Ft.	3,989 2/	3,203 2/	17,353 3/	24,545
Sediment Aerated	Ac. Ft.	625	469	1,580	2,674
Recreation Water	Ac. Ft.	50	39	395	484
Municipal and Industrial Water Retarding	Ac. Ft.	-	-	2,674	2,674
Surface Area	Ac. Ft.	-	-	2,426	2,426
Sediment Pool	Acres	3,314 2/	2,695 2/	10,278 3/	16,287
Recreation Water Pool	Acres	93	60	218	371
Municipal and Industrial Water Pool	Acres	-	-	402	402
Retarding Pool	Acres	-	-	540	540
	Acres	315 2/	195 2/	994 3/	1,504

TABLE 3 - STRUCTURAL DATA
STRUCTURES WITH PLANNED STORAGE CAPACITY

Rabon Creek Watershed, South Carolina

Item	Unit	Structure Number			Total
		20	21	32	
Principal Spillway Design					
Rainfall Volume (areal) (1 day)	In.	7.11	7.14	6.83	
Rainfall Volume (areal) (10 day)	In.	12.36	12.39	12.09	
Runoff Volume (10 day)	In.	5.60	5.62	6.02	
Capacity (Max.)	cfs.	312	250	865	
Frequency of Operation - Emer. Spwy.	% chance	1	1	1/	
Size of Conduit	In.	48	42	72	
Emergency Spillway Design					
Rainfall Volume (ESH) (areal)	In.	8.16	8.29	8.74	
Runoff Volume (ESH)	In.	4.60	4.71	5.48	
Storm Duration	Hrs.	6	6	15.54	
Type		veg.	veg.	conc. 1/	
Bottom Width	Ft.	188	110	150	
Velocity of Flow (Ve)	Ft./Sec.	4.6	6.3	-	
Slope of Exit Channel	Ft./Ft.	.04	.04	.33	
Max. Water Surface Elev.	Ft.	719.2	689.5	544.3	
Freeboard Design					
Rainfall Volume (FH) (areal)	In.	14.50	14.72	15.63	
Runoff Volume (FH)	In.	10.38	10.59	11.93	
Storm Duration	Hrs.	6	6	15.54	
Max. Water Surface Elev.	Ft.	724.5	696.0	551.5	
Capacity Equivalents					
Sediment Volume	In.	0.75	0.69	0.59	
Retarding Volume	In.	3.69	3.68	3.09	
Recreation Water Volume	In.	-	-	0.80	
Municipal and Industrial Water	In.	-	-	0.73	

1/ Crest elevation of 150 foot wide reinforced concrete chute spillway is 537.0. Storage between principal spillway crest and chute spillway crest is 40 percent chance runoff from uncontrolled drainage area. The chute spillway functions as the second stage of the principal spillway and as the emergency spillway.

2/ Crest of emergency spillway.

3/ Top of flood pool, elevation 543.4, is maximum elevation of pool during 100 year frequency principal spillway design storm.

TABLE 4 - ANNUAL COST

Rabon Creek Watershed, South Carolina

(Dollars) 1/

Evaluation Unit	Amortization of Installation Cost 2/	Operation and Maintenance Cost	Total
Floodwater Retarding Structures 20 and 21, Multiple Purpose Structure 32, and Recreational Facilities	149,400	16,300 3/	165,700
Project Administration			4,600 2/
TOTAL	149,400	16,300	170,300

1/ Price base: 1973.

2/ Amortized at 5-5/8 percent interest rate for 100 years.

3/ Includes \$13,200 for operation and maintenance of recreational facilities, \$1,600 for operation and maintenance of the three structures and \$1,500 for replacement of recreational facilities.

April 1974

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Rabon Creek Watershed, South Carolina

Item	(Dollars) 1/		
	Estimated Average Annual Damage		Damage Reduction Benefit
	Without Project	With Project	
Floodwater			
Crop and Pasture	18,100	3,600	14,500
Other Agricultural	4,700	1,400	3,300
Road and Bridge	5,400	1,900	3,500
Subtotal	28,200	6,900	21,300
Sediment			
Overbank deposition	5,400	1,900	3,500
Swamping	300	100	200
Lake Greenwood	46,400	11,200	35,200
Subtotal	52,100	13,200	38,900
Erosion			
Flood plain scour	300	100	200
Subtotal	300	100	200
Indirect	13,200	3,300	9,900
TOTAL	93,800	23,500	70,300

1/ Price base - current normalized for crop and pasture damage reduction; current prices for all other values.

April 1974

TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Rabon Creek Watershed, South Carolina

Evaluation Unit	(Dollars)							Average Annual Cost 2/	Benefit Cost Ratio
	AVERAGE ANNUAL BENEFITS 1/								
	Damage Reduction	More Intensive Land Use	Recreation	Water M&I	Incidental Land Enhancement	Secondary	Redevelopment	Total	
Floodwater Retarding Structures 20 and 21, and Multiple Purpose Structure 32	67,200 3/	31,000	85,800	60,500	5,600	39,300	27,400	316,800	165,700 1.9 to 1
Project Administration	67,200	31,000	85,800	60,500	5,600	39,300	27,400	316,800	4,600 170,300 1.9 to 1
GRAND TOTAL									
1/ Price base - current normalized for crop and pasture damage reduction; current prices for all other values.									
2/ From Table 4.									
3/ In addition, it is estimated that land treatment measures will provide damage reduction benefits of \$3,100 annually.									

1/ Price base - current normalized for crop and pasture damage reduction; current prices for all other values.
 2/ From Table 4.
 3/ In addition, it is estimated that land treatment measures will provide damage reduction benefits of \$3,100 annually.

April 1974

TABLE 7 - CONSTRUCTION UNITS

Rabon Creek Watershed, South Carolina

(Dollars) 1/		
Measures in Construction Unit	Annual Benefit	Annual Cost
1. Structure 20	27,700	18,900
2. Structure 21	25,700	16,300

1/ Price base: Benefits - Current Normalized
Installation Cost - 1973

April 1974

TABLE 8 - WATER WELLS IN RABON CREEK WATERSHED,
MAXIMUM CONSUMPTION FROM WELLS AND THEIR CHEMICAL ANALYSES 1/

Well Location and Number	Maximum Consumption MGD	Test Date	Solids 2/	Alkalinity	Calcium	Magnesium	Hardness	Iron	Chlorides	Acidity	Copper	Zinc
Gray Court 130003	.138 (5 wells)	12-71	96	19	5.6	1.5	20		12	6.2	.5	
		06-72	86	35	4.8	1.4	18		8	6.8	.6	.6
		01-73	66	39	3.8	1.2	15	.1	8	7.4	.2	.5
Hickory Tavern 530002	.017	07-73	76	22	2.8	.9	11		2	6.8	.4	1.2
		12-71	58	27	3.1	.9	12		1	7.2	.4	.4
		06-72	78	28	2.7	.8	10		2	7.2		7.0
Colonial Acres 530003	.020	12-72	54	30	3.6	1.1	14		3	7.1	.3	.2
		06-73	54	24	3.2	1.3	13		3	7.2		.3
		12-71	28	8	.9	.5	4		3	6.5	.5	.4
Hickory Heights 530004	.012 (2 wells)	06-72	44	8	1.0	.6	5		4	6.1	.1	2.4
		12-72	36	12	1.0	.7	5		4	6.3	1.7	.1
		06-73	24	2	1.1	.9	6		4	6.1	1.1	.1
Dillard, T.P. No. 1 630005	.014 (2 wells)	12-71	76	32	2.3	.9	10		1	6.9		2.5
		06-72	82	31	1.7	.9	8		2	6.6		8.2
		12-72	66	26	2.4	.8	9	.1	8	7.0	.1	1.3
Dillard, T.P. No. 2 630009	.014 (2 wells)	06-73	82	22	2.0	.9	9		3	7.1		.3
		12-71	62	37	3.8	1.4	15		1	6.7		.1
		06-72	94	37	3.2	1.2	13		3	6.5		1.2
Dillard, T.P. No. 2 630009	.014 (2 wells)	12-72	92	38	3.7	1.3	15		4	6.5		.5
		06-73	78	34	3.5	1.6	15		5	6.9	.3	
		06-72	54	32	2.5	1.6	13		2	6.6		3.9
Dillard, T.P. No. 2 630009	.014 (2 wells)	12-72	84	36	2.7	1.7	14	.1	6	6.6	3.3	1.0
		06-73	96	32	2.4	1.7	13		5	7.1		.2

1/ South Carolina Department of Health and Environmental Control, 1974 Report.

2/ All measured in parts per million.

April 1974

TABLE 9 - CHARACTERISTICS OF STREAMS IN RABON CREEK WATERSHED

Stream and Area Described	Bottom Width (ft.)	Bank Side Slope	Channel Depth (ft.)	Debris in Channel	Bank Vegetation	Channel Bottom Material	Adjacent Bank Land Use	Amount of Sediment Present	Channel Bank Stability	Channel Alignment
South Rabon Creek, 1/4 mile below junction of Payne Branch	14	1:1	6	Slight	Trees, vines	Sand	Forest	Slight	Stable	Slight bends
South Rabon Creek, 2 miles SE of Rabon Creek Church	25	1:1	6.5	Slight	Trees, vines	Sand	East bank, cultivated West bank, forest	Heavy	Mostly stable	Gradual bends
South Rabon Creek, 2 miles N of junction with North Rabon Creek	39	1:1	7	Moderate	Few trees	Sand	Pasture	Heavy	Stable	Gradual bends
North Rabon Creek, 1/4 mile N of junction with State Highway 101	21	3/4:1	8	Slight	Trees, brush	Sand	East bank, pasture West bank, forest	Slight	Stable	Slight bends
North Rabon Creek, 1 mile S of State Highway 101	21	1:1	8	Moderate	Trees, brush	Sand & rock shoals	Forest	Slight	Stable	Slight bends
Mountain Creek, at junction with North Rabon Creek	18	1:1	9	Slight	Trees, brush	Sand	Pasture, forest	Moderate	Stable	Slight bends
Rabon Creek, 1 mile S of State Highway 252	42	1:1	4	Heavy logs, brush	Trees, brush	Sand	Forest	Heavy	Stable	Sharp bends
Dirty Creek, at junction with Rabon Creek	20	1:1	4	Moderate	Trees, brush	Sand	Forest	Slight	Stable	Slight bends
Rabon Creek, from Dirty Creek to 3 miles N of Lake Greenwood	40-50	1:1	4-6	Heavy logs, brush	Trees, brush	Sand	Forest, pasture	Heavy	Stable	Moderate bends
Rabon Creek, from 3 miles N of Lake Greenwood to backwaters of lake	40-50	1:1	3-5	Heavy logs, brush	Trees, brush	Sand	Forest, pasture	Heavy	Stable	Moderate bends

TABLE 10 - SURFACE WATER QUALITY IN RABON CREEK WATERSHED 1/

Station Number and Location	Date of Sample	Water Temperature (centigrade)	pH	Dissolved Oxygen (MG/L)	Fecal Coliform (No./100ML)	Biochemical	
						Oxygen Demand	5 Day (MG/L)
S-244 Bridge over South Rabon Creek at county line	71/ 4/29	13.0	6.5	8.1	-	-	0.8
	71/ 5/11	14.0	6.8	9.4	-	-	0.8
	71/ 5/17	15.0	6.1	8.1	790	-	0.6
	72/ 2/28	9.0	6.6	11.5	20	-	0.4
	72/ 2/29	10.0	6.4	12.0	160	-	0.5
	72/ 3/ 1	10.5	6.7	11.2	162	-	0.9
	72/ 3/ 2	13.5	6.7	10.3	640	-	0.3
	72/ 6/ 8	18.0	6.3	9.2	1,280	-	0.8
	72/ 7/27	19.5	6.5	7.9	-	-	-
	72/ 9/ 5	18.0	6.8	8.2	1,500	-	-
	73/ 4/ 5	15.0	6.3	9.7	-	-	2.0
	73/ 5/31	17.0	6.6	8.9	200	-	5.0
	73/ 6/12	20.0	6.7	9.9	190	-	1.3
	73/ 7/ 2	21.0	6.6	8.2	2,080	-	1.8
	73/ 7/23	20.0	7.2	8.4	-	-	-
	73/ 7/25	21.0	-	8.2	-	-	-
	73/ 8/20	20.0	6.8	8.0	900	-	3.3
	73/ 9/19	18.0	6.5	8.0	500	-	2.7
	73/10/22	14.0	6.5	9.7	2,600	-	3.1

TABLE 10 - SURFACE WATER QUALITY IN RABON CREEK WATERSHED 1/

Station Number and Location	Date of Sample	Water Temperature (centigrade)	pH	Dissolved Oxygen (MG/L)	Fecal Coliform (No./100ML)	Biochemical Oxygen Demand 5 Day (MG/L)
S-247 Bridge over South Rabon Creek on U.S. Highway 76	71/ 5/18	15.0	6.3	9.7	1,100	0.5
	71/ 5/19	16.0	6.4	8.6	1,100	0.2
	71/ 5/26	15.0	6.7	9.1	170	0.8
	72/ 6/ 8	16.5	6.5	9.8	300	0.7
	72/ 8/31	20.0	7.1	8.7	100	-
	72/ 9/ 5	19.5	6.8	8.2	70	0.5
	72/ 9/12	19.5	7.0	8.7	40	-
	72/10/16	13.5	7.1	10.0	140	-
	72/11/13	14.0	7.2	7.1	94	-
	73/ 4/ 5	15.5	6.3	9.2	100	2.2
	73/ 5/31	17.0	6.6	9.2	80	3.5
	73/ 7/ 2	22.0	6.7	8.3	350	2.0
	73/ 7/25	21.0	-	7.6	-	-
	73/ 8/20	20.0	6.8	8.3	700	1.5
	73/ 9/20	18.0	6.7	8.9	700	1.2
	73/10/22	14.0	6.8	9.6	360	1.8
S-095 Bridge over North Rabon Creek on U.S. Highway 76	62/ 8/20	22.8	7.0	8.1	-	0.9
	62/ 8/23	22.0	7.8	7.9	-	-
	63/ 6/12	20.0	6.9	8.8	-	1.1
	63/ 6/13	19.5	6.9	8.4	-	1.8
	63/ 6/14	20.5	6.9	8.3	-	1.0
	68/10/ 4	17.0	6.6	4.3	-	1.9
	68/10/ 7	15.0	6.9	9.1	-	1.2

TABLE 10 - SURFACE WATER QUALITY IN RABON CREEK WATERSHED 1/

Station Number and Location	Date of Sample	Water Temperature (centigrade)	pH	Dissolved Oxygen (MG/L)	Fecal Coliform (No./100ML)	Biochemical Oxygen Demand 5 Day (MG/L)
S-095 (continued)	70/ 7/15	22.5	6.2	7.4	-	2.8
	70/ 7/16	23.0	6.5	9.4	-	1.2
	70/ 7/17	21.0	6.3	7.8	-	1.0
	73/ 4/ 5	16.0	6.6	9.1	80	2.1
	73/ 5/31	19.0	6.7	8.7	160	4.8
	73/ 7/ 2	21.0	6.8	7.9	810	1.4
	73/ 7/25	21.0	-	7.5	-	-
	73/ 8/20	20.0	6.6	7.2	1,350	1.9
	73/ 9/20	19.0	6.6	8.1	850	1.3
	73/10/22	14.0	6.8	9.3	160	1.6
	71/ 5/18	16.0	6.3	8.9	490	0.6
	71/ 5/19	16.5	6.6	8.5	490	0.4
S-248 Bridge over Rabon Creek at State Highway 252	71/ 5/26	16.0	6.8	9.0	170	0.4
	72/ 5/ 9	17.5	6.1	7.4	1,540	2.4
	72/ 6/ 8	17.0	6.5	9.5	300	0.6
	72/ 9/ 5	19.0	7.2	8.3	180	0.2
	73/ 4/ 6	14.0	6.5	10.2	60	2.2
	73/ 6/ 1	18.0	6.7	8.7	250	1.9
	73/ 7/ 3	22.0	7.0	8.0	650	2.2
	73/ 8/21	20.0	7.1	8.3	406	0.7
	73/ 8/29	21.0	7.1	6.6	-	-
	73/ 9/18	21.0	6.8	8.0	600	2.7

TABLE 10 - SURFACE WATER QUALITY IN RABON CREEK WATERSHED 1/

Station Number and Location	Date of Sample	Water Temperature (centigrade)	pH	Dissolved Oxygen (MG/L)	Fecal Coliform (No./100ML)	Biochemical	
						Oxygen Demand	5 Day (MG/L)
S-096 Bridge over Rabon Creek at State Highway 54	62/ 8/20	23.0	6.9	8.0	-	-	0.4
	62/ 8/23	23.0	6.5	7.1	-	-	-
	63/ 6/12	22.0	7.1	7.7	-	-	1.3
	63/ 6/13	21.5	7.0	7.6	-	-	2.4
	63/ 6/14	22.0	7.0	7.7	-	-	1.1
	68/10/ 4	18.0	6.8	8.5	-	-	0.4
	68/10/ 7	15.0	7.1	8.9	-	-	1.3
	68/11/13	-	6.3	-	7,900	-	7.5
	68/11/14	-	6.4	-	2,300	-	2.6
	68/11/15	-	6.2	-	490	-	1.9
	68/11/18	-	5.9	-	2,300	-	5.0
	68/11/19	-	6.2	-	35,000	-	4.0
	68/11/20	-	5.8	-	7,000	-	1.1
	68/11/21	-	5.4	-	2,300	-	1.2
	69/ 3/19	12.0	5.8	11.6	1,100	-	2.6
	69/ 3/20	13.0	5.7	12.3	1,700	-	1.1
	69/ 3/21	12.0	6.4	10.5	170	-	1.3
	69/ 3/22	11.5	6.3	11.3	2,300	-	1.5
	69/ 3/23	12.0	6.4	12.8	700	-	1.8
	69/ 3/24	14.0	6.9	11.4	2,200	-	3.5

TABLE 10 - SURFACE WATER QUALITY IN RABON CREEK WATERSHED 1/

Station Number and Location	Date of Sample	Water Temperature (centigrade)	pH	Dissolved Oxygen (MG/L)	Fecal Coliform (No./100ML)	Biochemical
						Oxygen Demand 5 Day (MG/L)
S-096 (continued)	69/ 3/25	13.0	6.0	9.8	4,900	0.5
	69/ 3/26	11.0	6.6	10.1	330	1.3
	69/ 7/15	25.0	6.9	7.2	270	0.7
	69/ 7/16	23.0	7.2	7.4	1,300	2.8
	69/ 7/17	23.5	7.5	6.5	490	2.4
	69/ 7/18	24.0	7.3	7.3	790	1.9
	69/ 7/19	25.0	6.8	7.6	490	1.6
	69/ 7/20	26.0	6.5	6.9	490	1.9
	69/ 7/21	24.0	6.9	7.3	490	1.2
	69/ 7/22	25.0	6.8	7.2	460	2.2
	71/ 5/18	17.0	6.4	8.8	490	0.9
	71/ 5/19	17.0	6.5	8.1	330	1.5
	71/ 5/26	17.0	6.7	9.1	230	0.4
	73/ 4/ 6	14.0	6.5	9.4	40	1.8
	73/ 6/ 5	20.0	6.8	9.3	260	2.2
	73/ 7/ 3	24.0	7.0	8.2	510	3.2
	73/ 7/30	24.0	-	8.1	-	-
	73/ 8/21	21.0	7.3	8.0	263	0.3
	73/ 9/18	21.0	6.4	7.6	625	2.0
	73/10/23	13.0	6.9	9.7	231	0.9

1/ Computer Data, Surface Water Quality Samples, South Carolina Department of Health and Environmental Control, 1973.



TABLE 11 - QUALITY STANDARDS FOR CLASS "B" WATERS 1/

Class "B" waters are suitable for domestic supply after complete treatment in accordance with requirements of the South Carolina Department of Health and Environmental Control. They are also suitable for propagation of fish, industrial and agricultural uses and other uses requiring water of lesser quality.

Items	Specifications
1. Fecal coliform	Not to exceed a geometric mean of 1000/100 ml based on five consecutive samples during any 30 day period; nor to exceed 2000/100 ml in more than 20 percent of the samples examined during such period (not applicable during or following periods of rainfall).
2. pH	Range between 6.0 and 8.5, except that swamp waters may range from pH 5.0 to pH 8.5.
3. Dissolved oxygen	Daily average not less than 5 mg/l, with a low of 4 mg/l, except that swamp waters may have an average of 4 mg/l.
4. Phenolic compounds	Not greater than 1 microgram per liter unless caused by natural conditions.

1/ Water Classification Standards System for the State of South Carolina, South Carolina Pollution Control Authority, 1972.

TABLE 12 - SOUTH CAROLINA DRINKING WATER STANDARDS 1/

The South Carolina Department of Health and Environmental Control collects samples of water from the distribution systems of public water supplies in South Carolina, and conducts chemical analyses in accordance with the Law, Rules and Regulations for Waterworks Systems in the State of South Carolina. These analyses are designed to determine if the finished water meets standards for chemical quality as set forth in the 1962 U.S. Public Health Service Drinking Water Standards. These analyses are also used to evaluate treatment processes where such processes are employed.

Characteristic or Chemical Substance	Limit
Total Solids	Should not exceed 500 mg/l
Turbidity	Should not exceed 5 t.u.
Color	Should not exceed 15 units
Alkalinity	Should not exceed 500 mg/l
Calcium	Related to hardness
Magnesium	Related to hardness
Hardness	Should not exceed 100 mg/l
Sodium	No standard. Provided as information for medical doctors when requested
Iron	Should not exceed 0.3 mg/l
Chloride	Should not exceed 250 mg/l
pH	Acceptable range from 6.5 to 8.5
Manganese	Should not exceed 0.05 mg/l
Copper	Should not exceed 1.0 mg/l
Zinc	Should not exceed 5.0 mg/l
Potassium	No standard. Provided as information for medical doctors when requested
Mercury	Should not exceed 0.5 ppb
Chromium	Should not exceed 0.05 mg/l
Cadmium	Should not exceed 0.01 mg/l
Lead	Should not exceed 0.05 mg/l

1/ Law, Rules and Regulations for Waterworks Systems in the State of South Carolina, South Carolina State Board of Health, November 1970.

INVESTIGATIONS AND ANALYSES

Land Use and Treatment

Present land use was determined from soil and water conservation district reports, surveys, and field studies. Estimates of future land use and treatment measures were made on the basis of the people involved, the land within the watershed, and present trends. Needed land use adjustments based on soil capabilities were considered in arriving at the land treatment measures planned for the watershed.

The land treatment program was formulated to meet the physical needs of the land. Land treatment goals were established by the soil and water conservation districts. Land treatment goals were based on the need to reduce erosion to within tolerable soil loss limits. When the plan is carried out, the watershed will be a showcase of conservation.

A systematic field survey showed ground cover, forest and hydrologic conditions, and treatment needs. The survey, supporting data, and information from other agencies and forestry officials determined the measures planned.

Critically eroding areas were located and identified by types and approximate size. This information was recorded on watershed base maps for reference.

The costs of installing the land treatment measures were developed by the Soil Conservation Service, the South Carolina State Commission of Forestry, and the U.S. Forest Service. Technical assistance costs were based on the present costs of the going district programs, the going Cooperative Forest Management Program, and the going Cooperative Forest Fire Control Program. Costs of installing land treatment measures were based on present prices paid by landowners and operators in the locality. The amount of private forest land treatment measures needed to meet treatment goals was based on a field survey of the watershed adjusted for expected participation during the installation period.

Structures

Vertical control necessary to survey valley cross sections for evaluating flooding problems and developing topographic maps of reservoir sites was based upon mean sea level datum as established by U.S. Coast and Geodetic Survey and U.S. Geological Survey. Temporary bench marks were established throughout the watershed.

Topographic maps with five foot contour intervals were made of the reservoir area of each floodwater retarding structure. These maps were made using low level aerial photography and the stereoplotter. The maps were used to develop stage-area and stage-storage curves and are adequate for final design.

Floodwater retarding structures were designed in accordance with SCS Engineering Memorandum 27. Structures were classified to establish their design criteria by considering the damage that might result from a sudden major breach of the earth dam embankment. All structures were classified

as class "B" since failure could cause damage to major roads and relatively important public utilities. The importance of Site 32 for municipal and industrial water storage and as a recreation area was also considered. Flood storage for each structure was determined, using the computer, by flood routing the 10-day hydrograph for the principal spillway design storm. Principal spillway discharge rates were selected based on downstream channel carrying capacities. These discharge rates were held to near the minimum that would empty the pool within 10 days. The emergency spillway and freeboard hydrographs were also routed using the computer. The principal spillways, the emergency spillways, and the chute spillway were proportioned to determine the most economical structures.

Investigations of abutments, the foundation, and borrow areas at Site 20 were made by surface inspection, hand augering, and use of a core drill. These investigations indicate that the emergency spillway crest can be located on rock, however, the inlet and outlet section will be primarily in earth and will be vegetated. Additional emergency spillway width is available if needed. Some borrow material will come from the excavated emergency spillway. A portion of the borrow will be obtained above the top of dam elevation.

At Site 21, all investigations were made by surface inspection and hand augering. Based on these investigations, the inlet and outlet of the emergency spillway will be in earth and will be vegetated, and rock is anticipated in the crest section. Additional emergency spillway width is available if needed in the right abutment. A portion of the borrow will be obtained above the top of dam elevation.

Davis and Floyd, Inc., of Greenwood, South Carolina, engineering consultants for the Laurens County Water Resources Commission, assisted the Commission in determining the quantity of municipal and industrial water to be stored in Site 32. They also determined that the quality of water was adequate and assisted in the preliminary design of the multiple purpose structure. The consultants assisted the Commission in determining the location of recreation areas at Site 32 and the facilities to be installed at each area.

The proposed location of Structure 32 is immediately downstream from the confluence of North Rabon Creek and South Rabon Creek. (See site location map on page 26A.) Preliminary surface inspection and hand augering at Site 32 revealed a need for more detailed investigations. Foundation investigations with a core drill were required to locate a satisfactory foundation for the conduit. The principal spillway location is in a saddle connecting the South Rabon Creek valley with the downstream Rabon Creek valley. The selected conduit location is parallel to the strike of foliation planes in the upstream limb of a southeast plunging fold mapped during the investigation. The pipe will be placed on a yielding foundation. The principal spillway system can be constructed with little chance of flooding if small dikes are constructed across each end of the saddle. The embankment fill can be placed and compacted over the principal spillway and across the Rabon Creek valley after the principal spillway is constructed. Additional investigations were made with the

core drill along the proposed centerline of the dam and in the proposed borrow area. A chute spillway location in the left abutment was investigated with the core drill and found suitable. All discharge from the site will pass through the principal spillway or the chute spillway. Some borrow material for the construction of the dam will come from the chute spillway area. The principal borrow area is located above the top of dam elevation.

Core drill investigations were also made at two other potential locations in the general area of Structure 32. Two principal spillway conduit lines were investigated at the first dam site selected. Uneven rocks profiles found under these lines investigated made them unacceptable. A second site was investigated just upstream from State Highway 252. Rock anticipated in the emergency spillway adjacent to the right abutment at this site was not consistent and was not acceptable as a rock spillway. The chute spillway site selected would also be acceptable with this embankment location; however, cost comparisons with the proposed site, considering the cost of moving the existing pump station and other land rights, showed the upper site's total cost to be more economical.

The plans for the recreational areas and facilities were developed by the Soil Conservation Service and the Laurens County Water Resources Commission with assistance by Davis and Floyd, Inc., and the South Carolina Department of Parks, Recreation and Tourism. The recreational facilities are based on standard park design and layout. Comfort stations proposed are similar to others approved by the South Carolina Department of Health and Environmental Control in other parks. Costs were based on previously constructed facilities in state parks, by the Soil Conservation Service, and from data compiled by the Federal Power Commission.

Estimates of sediment storage were made in accordance with SCS procedures. Sediment storage was computed using submerged unit weights of 60 to 66 pounds per cubic foot and aerated weights of 83 to 86 pounds per cubic foot. Aerated weights were considered similar to the dry unit weights of upland samples. Submerged unit weights were estimated. The amount of aerated sediment for the life of the structures is estimated to vary from 15 to 20 percent. Estimates of distribution were based on sediment texture, delivery ratios, shape and size of reservoirs, and entry slopes.

Additional Storage Potential

Structure 20 has an additional storage potential of approximately 650 acre feet and Structure 21 has approximately 1,200 acre feet before becoming involved with major fixed improvements. Other groups were informed of the additional storage available, especially for recreation water storage and a possible recreation development. However, no sponsor with sufficient funds was interested. If a sponsor is found prior to construction of these structures, it would be possible to supplement this work plan to include the additional storage.

Hydraulic and Hydrologic

Physical data for the economic evaluation and design of proposed works of improvement were developed from an analysis of the watershed which was made using procedures in the National Engineering Handbook, Section 4, Part 1, Watershed Planning.

Rainfall data from the U.S. Weather Bureau Technical Paper No. 40, "Rainfall Frequency Atlas of the United States" were used to develop the partial duration series of rainfall. Information obtained from local observation, the U.S. Forest Service, the District Conservationists, and the Soil Scientists was used to determine the weighted average runoff curve numbers. Runoff was determined by applying rainfall amounts to the weighted average curve number.

The principal spillway, emergency spillway, and freeboard hydrographs were developed in accordance with Chapter 21 of the National Engineering Handbook, Section 4, Part 1, Watershed Planning. Stage-discharge relationships for representative cross sections were determined using water surface profile computations performed by the IBM 1130 Computer. Stage-area flooded data, by depth increments, for these cross sections were also calculated by the computer. The 1, 10, 33, 50, 100, and 300 percent chance storms were routed through representative cross sections using the convex method of routing by the IBM 1130 Computer.

Reservoir operation studies were made on Structure 32, which is in series with Structures 20 and 21. These studies were accomplished using the 1130 Computer and the following data:

1. Area-storage curves for each structure were developed.
2. The most critical drought period on record (calendar years 1952 through 1956) was selected for the study.
3. The U.S. Geological Survey stream gage records on Reedy River near Greenville, South Carolina, were used to determine monthly inflow in inches.
4. The following records were used to compute the net evaporation from the reservoir surface:
 - a. U.S. Weather Bureau Class A pan records at Union, S.C.
 - b. U.S. Weather Bureau standard rain gages at Greenville, S.C., and Laurens, S.C.

Geology

An inventory for mileage of perennial, intermittent, and ephemeral streams was made for the watershed. This inventory was made using field surveys and measurements from established maps of the area. Local residents were consulted concerning stream flow during the dry season

and the field survey was made after a dry period of considerable length. There are approximately 200 miles of perennial streams, 350 miles of intermittent streams and a great number of miles of ephemeral drains within the watershed. As best determined, approximately three miles of ephemeral drain is required to originate an intermittent stream in this section of the Piedmont. This is about the normal drainage from 300 acres.

A bedload transport equation was used to determine the potential for channel capacity changes below Structure 32. Calculations were made for the three and 10 year frequency storms for "future with project" and the three, 10, and 25 year frequency storms for "future without project" conditions. Present field conditions were assumed to be comparable to "future without". The effects of these various storms for "future with" and "future without" project conditions were compared to determine the amount of increased channel capacity that will develop following project installation. This study indicates that a gradual increase in channel capacity will occur downstream of Structure 32 to the backwaters of Lake Greenwood.

An estimate of average annual suspended sediment concentration at the watershed outlet was made following procedures outlined in Chapter VIIA of the "Guide to Sedimentation Investigations", prepared by the E&WP Unit of the South Regional Technical Service Center, October 1969. Sediment storage requirements for each structure were determined by following procedures outlined in Chapters 8 and 9 of the Guide.

A study of physical damages to the flood plains of the watershed was conducted by surface inspection of flood plain reaches, followed by sub-surface investigations. The extent and degree of swamping were noted. Damages were summarized by evaluation reaches and adjusted for recoverability of productive capacity. Estimates of recoverability were developed from field studies and interviews with landowners. Sediment yield to Lake Greenwood was calculated for "future with" and "future without" project conditions. The "future with" yield includes an estimate of that amount of sediment contributed by the slight channel degradation expected. Calculations of reduction in sediment yield by evaluation reaches were made to determine reduction due to structural and land treatment measures. Erosion rates for each soil unit and land use were determined by using the Musgrave Equation (modified).

Fish and Wildlife

Representatives of the South Carolina Wildlife and Marine Resources Department and the U.S. Bureau of Sport Fisheries and Wildlife made a joint field survey of the watershed to help in the preparation of the fish and wildlife resource inventory and an analysis of the effect of project installation on this resource.

The Soil Conservation Service biologist made an independent survey of the watershed to complete the fish and wildlife resource inventory. The Service biologist also assisted in assessing the effect of the project on the fish and wildlife resource.

Economics

Methods used in making the economic investigations and analyses followed those approved by the Soil Conservation Service in benefit-cost evaluation of land and water resource projects. Basic data were obtained from landowners, agricultural workers, experiment stations, city and county officials, state highway department personnel, university and USDA publications, and private engineers.

Current normalized prices were used in benefit computations. Current (1973) prices were used for estimating installation costs and operation and maintenance. The costs of all structural measures were amortized over a 100-year period using 5-5/8 percent interest rate.

Owners and operators of flood plain land were interviewed to determine land use and to estimate yields with various degrees of protection from flooding. These data were summarized by evaluation reaches. Damage values were derived from these summaries and from cost-price information. Yields used in the analysis are those that would normally be expected in the future without and with the project.

Sediment damage reduction benefits to flood plain land were estimated on the basis of increased net income which is expected to accrue as a result of recovery of land damage. An equivalent of 342 acres damaged 100 percent by sediment was used as the basis for deriving these benefits. Consideration was given to the degree of recovery that can be expected and the probable time required for recovery.

Sediment damage reduction benefits to Lake Greenwood were based on the cost of removing sediment from Rabon Creek just before it enters the lake. The projected sediment accumulation in Lake Greenwood from Rabon Creek Watershed without the project is 58 acre feet per year and with the project is 14 acre feet per year. The cost of pumping or dredging sediment is estimated to cost \$800 per acre foot. Thus: 58 acre feet @ \$800 = \$46,400; 14 acre feet @ \$800 = \$11,200; and \$46,400 less \$11,200 gives a net benefit of \$35,200. It is assumed that the salvage value of the sediment will equal loading, hauling, and storage.

More intensive land use benefits were calculated on the basis of expected increase in crop yields. This increase in yield level would result from increased use of fertilizers and better managerial practices made profitable by reducing the flood hazard. Future flood damages to these higher damageable values were deducted from gross benefits. The soils of the flood plain are mostly Class IIIw. The planned land use is within the capabilities of the flood plain soils.

Benefits from restoration of former productivity were estimated on the basis of increases in net income due to reduction in flood hazards. Associated costs and increased damages due to higher damageable values with the project were deducted from gross benefits. Special attention was given in the evaluation procedure to avoid the possibility of double counting benefits.

Future flood plain use without the project is estimated to be 2,200 acres of crops and pastures and 4,200 acres of idle land, forest, and land in other uses. Future flood plain use with the project is estimated

to be 2,900 acres of crops and pastures, and 3,500 acres of idle land, forests, and land in other uses.

Indirect damages were estimated to be 10 percent of direct floodwater and sediment damages to cropland and pastureland and 20 percent of other agricultural and nonagricultural damages.

Enhanced property values that will come about as a result of the project were derived by comparing the present value of building sites with utilities in the immediate vicinity with the estimated worth of the same properties with a water-front boundary. A net increase of \$1,000 each for 120 lots amounted to \$120,000. This was amortized, using 5-5/8 percent interest for 100 years. The length of desirable water edge was used as a basis for the estimate of lot numbers. Local land prices where development has taken place were used for the increased value.

Domestic and industrial water benefits were estimated to be equal to the value of the least costly alternative. A single purpose structure at the site of multiple purpose Structure 32 was determined to be the least costly alternate by the engineering firm representing the Laurens County Water Resources Commission. An estimated installation cost was made and this cost was amortized at 5 percent interest for 100 years to determine annual benefits.

Recreation benefits of 49,000 visitor days per year are valued at \$1.75 per visitor day.

Redevelopment benefits resulting from installation of project measures are based on utilization of unemployed or underemployed local labor. Wage payments to local labor during construction were estimated to be 20 percent of the construction costs. This value was amortized at 5-5/8 percent interest for 100 years to arrive at annual benefits. Fifty percent of the operation and maintenance costs were used as the value of annual wages paid to local labor. This value was treated as a decreasing annuity for 20 years at 5-5/8 percent interest and converted to an annual equivalent over the project life.

The value of local secondary benefits stemming from the project were estimated to be 10 to 20 percent of the direct primary project benefits. Indirect and redevelopment benefits were excluded when computing secondary benefits. The value of local secondary benefits induced by the project were estimated to be 10 percent of the increased costs that producers will incur in connection with increased or sustained production and costs associated with development of the recreational areas and building lots around the permanent pools. Secondary benefits from a national viewpoint were not evaluated.

Installation costs of Structure 32 were allocated by the Use of Facilities Method. Construction and engineering costs were allocated according to the amount of water stored for each purpose. Total storage of 17,353 acre feet was allocated as follows: 12,252 acre feet (70.6%) to flood prevention; 2,674 acre feet (15.4%) to recreation; and 2,426 acre feet (14.0%) to municipal water.

Land rights at Site 32 were allocated according to paragraph 108.072 of the Watershed Protection Handbook. The area eligible for cost sharing

is 1,154 acres. Of this total, 138 acres (12%) were allocated to municipal and industrial water and the remainder (88%) to recreation. The area of the flood pool not eligible for cost sharing (426 acres) was allocated to flood prevention.



SITE NUMBERS AND DRAINAGE AREA IN ACRES

SITE NO	ACRES
20	10,765
21	8,761
32	59,514

- LEGEND**
- DUAL LANE HIGHWAY
 - PAVED ROADS
 - IMPROVED ROADS
 - UNIMPROVED ROADS
 - FEDERAL HIGHWAY NUMBERS
 - STATE HIGHWAY NUMBERS
 - DRAINAGE
 - WATERSHED BOUNDARY
 - DRAINAGE AREAS CONTROLLED BY STRUCTURE
 - PRE-BENEFITED
 - FLOODWATER RETARDING STRUCTURE
 - MULTIPLE PURPOSE STRUCTURE (M-MUNICIPALITY, R-RECREATION)
 - SITE NO
 - RECREATION ACCESS AREA

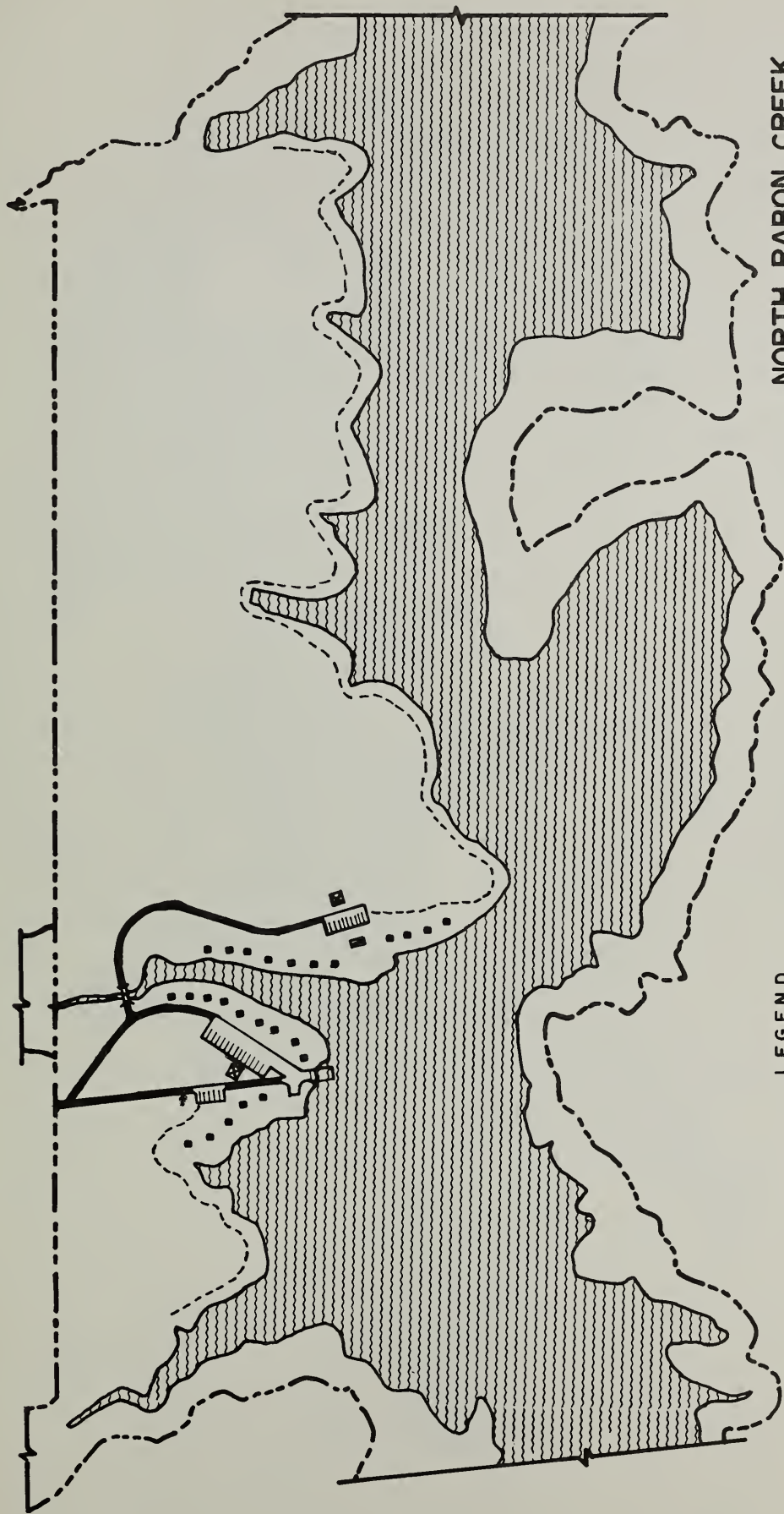
PROJECT MAP
RABON CREEK WATERSHED
GREENVILLE AND LAURENS COUNTIES
SOUTH CAROLINA

APPROXIMATE SCALE 1:100,000

Contour interval 100 feet (30.48 m)
and 50 feet (15.24 m) in some areas
Elevation 100 feet (30.48 m) is indicated







LEGEND

- PAVED ROAD
- FOOT TRAIL
- PARKING AREA
- PICNIC TABLE
- PICNIC SHELTER
- COMFORT STATION
- BOAT RAMP
- PURCHASE BOUNDARY

STRUCTURE 32

LAURENS COUNTY SOUTH CAROLINA
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
COLUMBIA, SOUTH CAROLINA

200 0 200
SCALE IN FEET





LEGEND

- PAVED ROAD
- FOOT TRAIL
- PARKING AREA
- PICNIC TABLE
- PICNIC SHELTER
- COMFORT STATION
- BOAT RAMP
- PURCHASE BOUNDARY

SOUTH RABON CREEK RECREATIONAL AREA RABON CREEK WATERSHED

STRUCTURE 32
LAURENS COUNTY SOUTH CAROLINA
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
COLUMBIA, SOUTH CAROLINA

